Using

the

IntelliLogger™

April 30, 2009

1 TABLE OF CONTENTS

1 Table of Contents 1-2

2 Introduction 20

Manual Overview 20

IntelliLogger™ System: `The BIG PICTURE' 20

IntelliLogger System Components 20

IntelliLogger System Base 20

Interface Modules 21

HyperWare-II Software 22

Accessory Components 23

Features 23

3 IntelliLogger System Base 25

Overview 25

Model Variations 25

Enclosure and Mounting 26

User Interface 28

Buttons 28

Power Switch 29

Status Indicator LEDs 29

Liquid Crystal Display 29

Indicators 31

Power and Ground Connections 31

Power and Ground 31

Chassis Ground 32

Power Fuse 32

Analog Inputs 32

Configuration Switches 32

Programmable Input Types and Ranges (Channels AI_A and AI_B) 33

Thermocouple Types and Ranges 33

Voltage and Current Ranges 34

Fixed Input Type and Range (Channel AI_C) 34

Over-current Protection Fuses 34

Common Mode Input Range 34

Analog Input Program Net Configuration 34

GPDI; General Purpose Digital Inputs 35

GPDI Input Signal Connections 35

Shielding 35

GPDI Event Input Application 35

GPDI Counter Input Application 36

GPDI Frequency Input Application 36
+5V Output 36
Load Connections 36
Output Characteristics 36
Digital Outputs 37
Load Connections 37
Output Characteristics 37
Relay Outputs 37
Load Connections 37
Switching Capacity 37
Relay Energized LED indicators 37
Analog Outputs 38
Load Connections 38
Output Characteristics 38
Communication Connections 38
RS-232 (PC) 38
RS-232 (Comm) 38
USB 38
BBus 39
Ethernet 39
Compact Flash Socket 39
4 Interface Modules 40
Overview 40
BBus Interconnect 40
Internal ILIM-7 Interface Module 40
External Interface Modules 41
Interconnect Cabling 41
Module Address 41
Reflash Firmware 42
Module Name 43
BBus Power Booster (BPB-1) 43
ILIM-7; Isolated Analog Input Module 44
Internal vs Stand-Alone External ILIM-7 Modules 44
Analog Inputs 46
Excitation Output 51
BBus Connection 53
Mounting 55
Surface Mounting 55
Module Stacking 56
5 Software Introduction 59
HyperWare-II Overview 59

HyperWare-II Features 59
HyperWare-II Installation 59
HyperWare-II 60
GreenWater™ 60
Training Videos 60
HyperWare-II Organization 60
Communication Window 60
Net Programming Window 62
Real-Time Trending Window 63
Custom Web Page Designer 63
Navigating between Windows 64
Helpful Hints 64
ToolTips 64
Status Bar 64
6 Communication 65
Overview 65
Establishing a USB Connection 66
Cable Connection 66
Driver Installation 66
Installation Error Recovery 71
Adding a USB Connection to the Connection Dialog 75
Connecting 76
Disconnecting 76
Establishing an RS-232 Connection 77
Cable Connection 77
Adding an RS-232 Connection via the Logger Connection Dialog 77
Connecting 78
Disconnecting 78
Establishing a PSTN Telephone Modem Connection 79
Modem Connection 79
Connecting 81
Disconnecting 81
Establishing an Ethernet Connection 81
1. Establish a USB or RS-232 Connection 81
2. Network Parameter Configuration Settings 81
3. Upload the Configuration to the Logger 84
Cable Connection 84
Adding a Network Connection via the Logger Connection Dialog 85
Connecting 86
Disconnecting 86
Establishing a Wireless Ethernet Connection 87

Establish an Ethernet connection 87
Change the Network parameters 87
Connecting the MultiTech™ Cellular Modem 89
Adding a Network Connection via the Logger Connection Dialog 90
Connecting 91
Disconnecting 92
7 Communication Window 93
Overview 93
Window Layout 93
Connection Status 93
Logger Model 94
Connected Interface Modules 94
Overlaying Icons 94
Graphic Commands 94
Icon Drag and Drop Operations 94
Net Upload 95
CF Card Reader 96
System Status 99
Unit Name and Unit ID 99
Version 99
Operational Mode 100
Logger Time 100
Program Name and Description 100
Memory 100
Supply Voltage and Lithium Battery State 100
Quick Probes 101
Download Data 102
Download Net 102
Logger Control 102
Enable 102
Stop 103
Clear 103
Set Logger Time 103
Reflash Firmware 103
Download the firmware file onto the PC 104
Connect to the Logger via HyperWare-II 104
Stop the Logger 104
Retrieve all data, and a copy of the Program Net 105
Reflash the code 105
Reset Logger and reconnect 106
Load a Program Net into the Logger 106

System Configuration 106
To access the Logger Configuration dialog: 106
System Tab 108
Calibration Tab 113
Communication Tab 114
Network Tab 116
Modem Tab 119
Modbus Tab 121
Interface Module Identifications 127
Module Type 127
Address 128
Serial Number 128
Version 128
Module Name 128
8 Icon Based Programming 129
Overview 129
An Example Program Net 130
Net Programming Window 131
Open Net and Save Net Buttons 131
Poll for Hardware (New) Button 132
Program Net Construction 133
Configuration details that must match include: 133
Icons 134
Icon Topography 135
To Develop a New Program Net... 136
Configuring the Hardware 136
Connect HyperWare-II to the Logger 136
Poll the Hardware Configuration 136
Add icons from the Net Programming Palette 137
Select and Connect icons 137
Configuring Icons 140
Saving the Net 142
Review Net Performance 142
Program Net to Upload to the Logger 144
View options 144
Paper Color 144
Status Bar 144
Program Net Documentation 144
Edge Connector Wiring Printout 144
9 Modbus Interface with the IntelliLogger 146
Modbus RTU Master Mode 146
Example Program Net in RTU Master Mode 146

Sequence of Steps to Use the Modbus RTU Master Mode 146
Modbus RTU Slave Mode 149
Example Program Net in RTU Slave Mode 150
Sequence of Steps to Use the Modbus RTU Slave Mode 150
Dedicated Use Status Addresses 150
Considerations in Use: 151
Modbus TCP Server Mode 151
Sequence of Steps to Use the Modbus TCP Server Mode 151
Modbus Network Connectivity 151
Modbus TCP Connections 152
Modbus RTU 152
10 Real-Time Trending 155
Real-Time Trending Window 155
Design Window 155
Viewing via Real-Time Trending Window 156
Construction of the Display 156
Activating the Display 156
Remote Control 157
Viewing via GreenWater™ 159
Accessing Remote Values 160
Accessing the Display 161
11 Custom Web Pages 163
Designing Custom Web Pages 163
Web Design Window 163
Real-Time Trending Window 163
Design Window 164
Viewing Web Pages 173
GreenWater 173
Real-Time Trending 173
12 Data Download 174
Overview 174
Formats 174
CSV, TSV 174
TXT 175
XID 175
Size of Data Download Files 175
Data download Steps 175
Open Download Dialog 175
Select the data to be downloaded 178
Specify the destination file format and filename 180

data review/analysis 180
Data Processing 181
Verify Data File Integrity 181
Convert XID File 182
Plot Raw Data (XID) File 183
13 GreenWater™ Browser Interface 186
Overview 186
Menu/Toolbar Commands 186
Logger Web Pages 187
Home/Status Tab 187
Title 187
Identification 188
Active Messages 188
Memory Status 189
Voltages 189
Current Values and Control Tab 190
Current Probe Point Values 190
Remote Control 190
Logged Data Listing Tab 191
View / Download Data 191
Logging Session Erasure 194
Custom Pages Tab 195
14 Appendix A: Program Net Palette Icon Reference 197
Terminals 197
Configuring Icons 197
Comparator Icon 198
Function: 198
Example Application Program Net: 198
Connection Terminals: 199
Configuration Dialog: 199
Configuration Options: 200
Conditional LCD Message (LCD status) Icon 202
Function: 202
Example Application Program Net: 202
Connection Terminals: 202
Configuration Dialog: 203
Configuration Options: 203
Constant Icon 206
Function: 206
Example Application Program Net: 206
Connection Terminals: 207

Configuration Dialog: 207
Configuration Options: 207
Counter Icon 208
Function: 208
Example Application Program Net: 208
Connection Terminals: 208
Configuration Dialog: 209
Configuration Options: 209
Custom Webpage (Web) Icon 211
Function: 211
Example Application Program Net: 211
Connection Terminals: 212
Configuration Dialog: 212
Configuration Options: 212
Function: 214
Example Application Program Net: 214
Connection Terminals: 215
Configuration Dialog: 215
Configuration Options: 215
Delay Icon 217
Function: 217
Example Application Program Net: 217
Connection Terminals: 217
Configuration Dialog: 218
Configuration Options: 218
Delta Icon 219
Function: 219
Example Application Program Net: 219
Connection Terminals: 219
Configuration Dialog: 220
Configuration Options: 220
Duty Cycle Icon 221
Function: 221
Example Application Program Net: 221
Connection Terminals: 221
Configuration Dialog: 222
Configuration Options: 222
Email Icon 223
Function: 223
Example Application Program Net: 223
Connection Terminals: 223
Email Troubleshooting Hints 224
Configuration Dialog: 225

Configuration Dialog – Message Tab: 225
Configuration Dialog - Data File Tab: 229
Configuration Dialog – Settings Tab: 231
File Transfer Protocol (FTP) Icon 233
Function: 233
Example Application Program Net: 233
Connection Terminals: 233
FTP Troubleshooting Hints 234
Configuration Dialog - FTP Destination Tab: 236
Configuration Options - FTP Destination Tab: 236
Configuration Dialog - Data File Tab: 238
Configuration Dialog – Settings Tab: 240
Filter Icon 242
Function: 242
Example Application Program Net: 242
Connection Terminals: 242
Configuration Dialog: 243
Configuration Options: 243
Latch Icon 245
Function: 245
Example Application Program Net: 245
Connection Terminals: 245
Configuration Dialog: 246
Configuration Options: 246
Latched LCD Message (LCD Event) Icon 247
Function: 247
Example Application Program Net: 247
Connection Terminals: 248
Configuration Dialog: 248
Configuration Options: 248
Logical AND Icon 251
Function: 251
Example Application Program Net: 251
Connection Terminals: 252
Configuration Dialog: 252
Configuration Options: 252
Logical Exclusive OR (XOR) Icon 253
Function: 253
Connection Terminals: 253
Configuration Dialog: 254
Configuration Options: 254
Logical Inverter (NOT) Icon 255

Function: 255
Example Application Program Net: 255
Connection Terminals: 256
Configuration Dialog: 256
Configuration Options: 256
Logical OR Icon 257
Function: 257
Example Application Program Net: 257
Connection Terminals: 258
Configuration Dialog: 258
Configuration Options: 258
Math Function Icon 260
Function: 260
Example Application Program Net One: 260
Example Application Program Net Two: 261
Connection Terminals: 261
Configuration Dialog: 262
Configuration Options: 262
Minimum and Maximum (Min/Max) Icon 266
Function: 266
Example Application Program Net: 266
Connection Terminals: 266
Configuration Dialog: 267
Configuration Options: 267
Modbus Slave / Server Device Icon 269
Function: 269
Example Application Program Net: 269
Connection Terminals: 269
Configuration Dialog: 270
Configuration Options: 271
Multiplexer (Mux) Icon 274
Function: 274
Example Application Program Net: 274
Connection Terminals: 274
Configuration Dialog: 275
Configuration Options: 275
Periodic Output (POI) Icon 276
Function: 276
Example Application Program Net: 276
Connection Terminals: 276
Configuration Dialog: 277
Configuration Options: 277

Probe Point (PP) Icon 279
Function: 279
Example Application Program Net: 280
Connection Terminals: 280
Configuration Dialog: 281
Configuration Options: 281
Rate of Change (ROC) Icon 282
Function: 282
Example Application Program Net: 282
Connection Terminals: 282
Configuration Dialog: 283
Configuration Options: 283
Remote Constant (Variable) Icon 284
Function: 284
Example Application Program Net: 284
Connection Terminals: 285
Configuration Dialog: 286
Configuration Options: 286
Remote Control (Switch) Icon 288
Function: 288
Example Application Program Net: 288
Connection Terminals: 288
Configuration Dialog: 289
Configuration Options: 289
R-S Flip Flop Icon 290
Function: 290
Example Application Program Net: 290
Connection Terminals: 290
Configuration Dialog: 291
Configuration Options: 291
Sample Rate Clock (SRC) Icon 292
Function: 292
Example Application Program Net: 292
Connection Terminals: 293
Configuration Dialog: 294
Configuration Options: 294
Scheduler Icon 296
Function: 296
Example Application Program Net: 296
Connection Terminals: 296
Configuration Dialog: 297
Configuration Options: 297

Start/Stop Clock Icon 300
Function: 300
Example Application Program Net: 300
Connection Terminals: 301
Configuration Dialog: 301
Configuration Options: 302
Statistical Average (Avg.) Icon 303
Function: 303
Example Application Program Net: 303
Connection Terminals: 303
Configuration Dialog: 304
Configuration Options: 304
Stop Icon 306
Function: 306
Example Application Program Net: 306
Connection Terminals: 306
Configuration Dialog: 307
Configuration Options: 307
Stopwatch Icon 308
Function: 308
Example Application Program Net: 308
Connection Terminals: 308
Configuration Dialog: 309
Configuration Options: 309
Summation Icon 310
Function: 310
Example Application Program Net: 310
Connection Terminals: 311
Configuration Dialog: 311
Configuration Options: 311
Text Note Icon 313
Function: 313
Example Application Program Net: 313
Connection Terminals: 313
Configuration Dialog: 314
Configuration Options: 314
Time Integral Icon 315
Function: 315
Example Application Program Net: 315
Connection Terminals: 315
Configuration Dialog: 316
Configuration Options: 316

Timed Counter Icon 318
Function: 318
Example Application Program Net: 318
Connection Terminals: 318
Configuration Dialog: 319
Configuration Options: 319
Warm-up Icon 321
Function: 321
Example Application Program Net: 321
Connection Terminals: 321
Configuration Dialog: 322
Configuration Options: 322
Warning Icon 323
Function: 323
Example Application Program Net: 323
Connection Terminals: 323
Configuration Dialog: 324
Configuration Options: 324
Window Comparator Icon 326
Function: 326
Example Application Program Net: 326
Connection Terminals: 326
Configuration Dialog: 327
Configuration Options: 327
15 Appendix B: System Base Icon Reference 330
+5Vdc Output Icon 330
Function: 330
Connection Terminals: 330
Configuration Dialog: 330
Configuration Options: 330
Analog Output (DAC) Icon 332
Function: 332
Connection Terminals: 332
Configuration Dialog: 332
Configuration Options: 333
Cold Junction Compensation (CJC) Icon 334
Function: 334
Connection Terminals: 334
Configuration Dialog: 334
Configuration Options: 335
Digital Output Icon 336
Function: 336

Connection Terminals: 336
Configuration Dialog: 336
Configuration Options: 336
Global System Settings (Program) Icon 338
Function: 338
Connection Terminals: 338
Configuration Dialog: 338
Configuration Options – System Tab: 338
Configuration Dialog – Front Panel/LCD Tab: 340
Configuration Dialog – Module XX (ILIM-7) Tab: 342
GPDI Event Mode Icon 344
Function: 344
Connection Terminals: 344
Configuration Dialog: 344
Configuration Options: 345
GPDI Counter Mode Icon 346
Function: 346
Connection Terminals: 346
Configuration Dialog: 346
Configuration Options: 347
GPDI Frequency Mode Icon 349
Function: 349
Connection Terminals: 349
Configuration Dialog: 350
Configuration Options: 350
LED Output Icon 351
Function: 351
Connection Terminals: 351
Configuration Dialog: 351
Configuration Options: 351
mA Input Icon 353
Function: 353
Connection Terminals: 353
Configuration Dialog: 354
Configuration Options: 354
Modbus Register List Icon 356
Function: 356
Configuration Dialog: 356
Configuration Options: 357
Relay Alarm Ic8on 361
Function: 361
Connection Terminals: 361

Configuration Dialog: 361
Configuration Options: 361
Supply Voltage (Battery) Icon 363
Function: 363
Connection Terminals: 363
Configuration Dialog: 363
Configuration Options: 364
Thermocouple (TC) Icon 364
Function: 364
Connection Terminals: 364
Configuration Dialog: 365
Configuration Options: 365
Vdc-Low Input Icon 367
Function: 367
Connection Terminals: 367
Configuration Dialog: 368
Configuration Options: 368
16 Appendix C: Custom Web Page Icon Reference 372
Overview 372
Icon – Name Cross Reference 373
Common Properties 374
Configuration Dialogs 374
Probe Point Link 374
Color Dialog 375
Color Bands 375
Font Dialog 376
Spin Control 376
Object Background 376
Scale Mode 377
Numeric Labels 378
Compass 378
Min/Max Tab 379
Angular Gauges (Linear and Logarithmic) 382
Probe Point Link 382
Scale Tab 382
Min/Max Tab 383
Graphics Tab 383
Color bands Tab 385
Bar Meters (Vertical and Horizontal) 386
Probe Point Link 386
Scale Tab 386
Min/Max Tab 387

Graphics Tab 388
Digital Readout 389
Analog Type Probe Point linked to the Digital Readout 389
Background 389
Character Segments 389
Quantity 389
Leading Digits 390
Hyperlink 391
Background 391
Font 391
Program Net Web Icon 391
Internet URL 391
Image 393
LED 394
Probe Point Link 394
LED Shape 394
Colors 394
Arrow Appearance 395
LED Bar Graph 396
Probe Point Link 396
Background 396
Range 397
Color Bands 397
Bar Graph Type 397
Linear Bar Graph Settings 397
Radial Bar Graph Settings 398
Linear Gauges (Vertical and Horizontal) 399
Probe Point Link 399
Scale Tab 399
Min/Max Tab 400
Graphics Tab 400
Color bands Tab 401
Logarithmic Gauges (Vertical and Horizontal) 402
Probe Point Link 402
Scale Tab 402
Min/Max Tab 403
Graphics Tab 403
Color bands Tab 404
Motor 405
Probe Point Link 405
Colors 405
Pipes 405

Background 406
Animation 406
Odometer 407
Probe Point Link 407
Background 407
General 407
Integer Digits 408
Decimal Digits 408
Pipe 409
Probe Point Link 409
Colors/Shapes 409
Flow Animation 410
Plotter Object 410
Tank Level 412
Probe Point Link 412
Tank Level Range 412
Background 412
Tank Sightglass Shape 413
Tank Colors 413
Text Label 413
Background 414
Label Text 414
Thermometer 415
Probe Point Link 415
Scale Tab 415
Min/Max Tab 416
Graphics Tab 416
Toggling Text 418
Probe Point Link 418
Threshold 418
Below/Above Threshold Message 418
Valve 419
Probe Point Link 419
Input State affects 419
Background Color 419
Color When Input is LOW / HIGH 419
Viewing Web Pages 420
GreenWater 420
Real-Time Trending 420
Web Page Design 420
17 Appendix D: ILIM-7 Module Icon Reference 421

Isolated Cold Junction Compensation (CJC) Icon 421
Function: 421
Connection Terminals: 421
Configuration Dialog: 422
Configuration Options: 422
Isolated Current (mA) Icon 423
Function: 423
Connection Terminals: 423
Configuration Dialog: 424
Configuration Options: 424
Isolated Low Voltage (Vlo) Icon 427
Function: 427
Connection Terminals: 427
Configuration Dialog: 428
Configuration Options: 428
Isolated HIGH Voltage (Vhi) Icon 432
Function: 432
Connection Terminals: 432
Configuration Dialog: 433
Configuration Options: 433
Isolated Thermocouple (TC) Icon 436
Function: 436
Connection Terminals: 436
Configuration Dialog: 437
Configuration Options: 437
18 Notes 440
19 Revision History 441
April 30, 2009 441
March 12, 2009 441
February 12, 2009 441
January 29, 2009 441
20 Index 442

2 INTRODUCTION

MANUAL OVERVIEW

This User's manual provides information relative to the use of the IntelliLogger™ Portable Data Logging System manufactured by Logic Beach Incorporated, La Mesa, CA. The manual is organized into sections describing the main components of an IntelliLogger system, from the System Base through the various features within the provided HyperWare-II software. The last section of the manual consists of the Appendices that give detailed specifications and information for general reference and advanced applications.

After following the instructions for the installation of the HyperWare-II software, much can be learned by exploring this manual, the software and the hardware in any order... without concern for damaging results. However, *it is HIGHLY RECOMMENDED that this User's manual be read in its entirety before deploying the IntelliLogger in a real application*.

Throughout the manual, instructions on PC keyboard entry or menu selections via mouse are specified by using italic print such as *ENTER* which refers to the `Enter' Key on the keyboard or *FILE* which refers to the menu item titled `FILE'.

INTELLILOGGER™ SYSTEM: `THE BIG PICTURE'

The IntelliLogger is a rugged, low-power stand-alone instrument that samples analog and digital inputs from various signals and sensors, processes the data, then stores it to internal memory for later analysis. In addition to data acquisition, the IntelliLogger simultaneously performs local alarming as well as output of data via FTP, Email, SMS and standard and Custom Web Pages via its integral Web Page Server.

With its rugged design, it is well suited to most environments ranging from industrial plant floors to vehicle to outdoor environments. As a low-power instrument, it is well suited to battery operation. The IntelliLogger finds itself equally at home as a permanent plant monitoring system or a remote field data logging instrument.

The IntelliLogger is accompanied by HyperWare-II software, which is used for configuration of the system and data review. Data and current readings can also be viewed via a standard Web page browser or the custom pages can be viewed with the free Logic Beach GreenWater™ browser.

INTELLILOGGER SYSTEM COMPONENTS

An IntelliLogger portable data logging system consists of a number of components... both hardware and software.

The main components of an IntelliLogger system are listed below and details follow:

- IntelliLogger System Base
- Interface Modules
- HyperWare-II Windows Application
- Accessory components such as modems, CF cards, M2M Probe Sweep Software, etc.

INTELLILOGGER SYSTEM BASE

The System Base refers to the main data acquisition instrument, which is provided in three models, the IL-10, IL-20 and the IL-80. The System Base includes analog and digital inputs and outputs, a Liquid Crystal Display (LCD), user buttons and various communication connectors.

Differences between models are explained in Chapter 2 and mainly relate to the analog and digital input/output (I/O) capacity and channel expansion features. An IL-80 is shown in Figure 2-1

Figure 2-1; IntelliLogger IL-80

INTERFACE MODULES

Channel count (analog and digital) in an IntelliLogger system can be expanded by the addition of one or more Interface Modules. Modules are connected to the System Base via the integral BBus connectors… allowing up to 16 modules to be daisy-chained.

One of the family of Interface Modules, the ILIM-7 (Figure 2-2) for example adds eight optically isolated analog input channels to the system. Each of the eight analog inputs can be user configured for use with thermocouple, voltage or current type inputs.

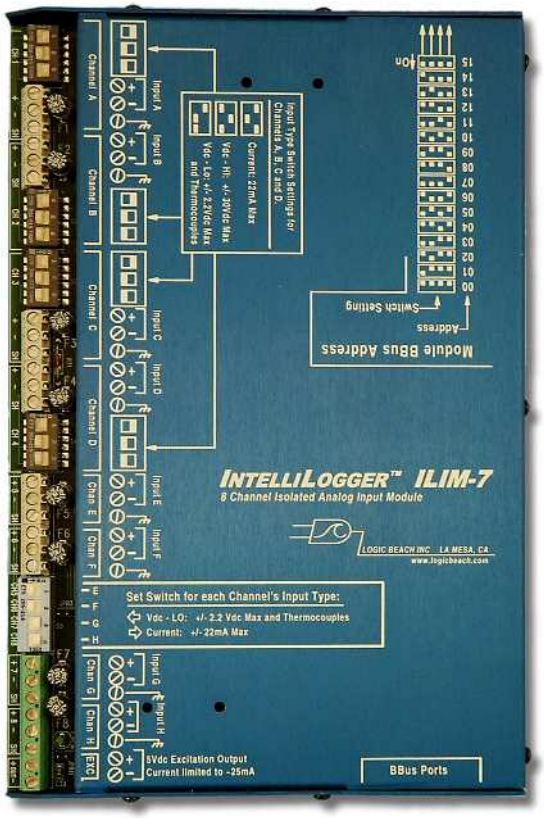


Figure 2-2; ILIM-7 Isolated Analog Input Interface Module

HYPERWARE-II SOFTWARE

Supplied with the IntelliLogger is a powerful Windows based software package called HyperWare-II (Figure 2-3).

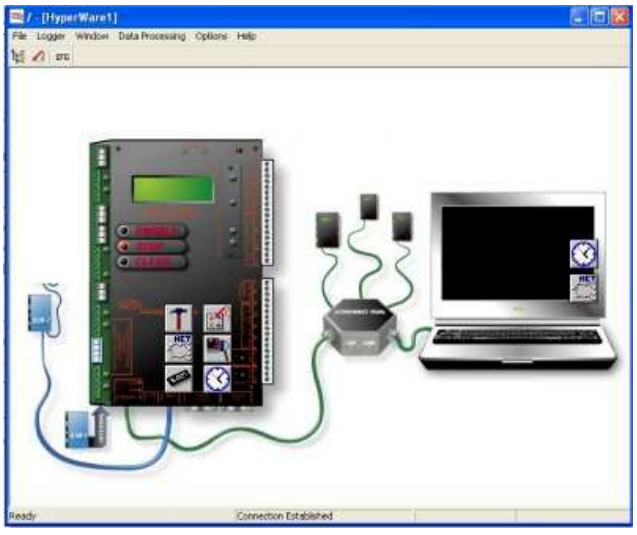


Figure 2-3; Communications Window with Ethernet Connection Established

HyperWare-II, running on a PC under the Microsoft Windows environment (98, 2000, XP) provides a multitude of functions for setup of the IntelliLogger as well as analysis of collected data including:

- Serial Communications support between the PC and the IntelliLogger for RS-232, USB, cellular and PSTN modem, and Ethernet.
- Programming of the IntelliLogger using the powerful HyperNet™ visual icon based programming method.
- Development of graphic Custom Web Pages with embedded sampled and calculated sensor and signal values.
- Multi-channel, graphic data display of previously collected data.
- Screen captures of Plotter graphs for seamless integration into other Windows based software applications such as word processors, spreadsheets, or desk-top publishing packages
- Download and conversion of collected data files to ASCII text or Microsoft Excel compatible file formats
- Real-Time graphical display of data as it is being processed by the IntelliLogger

ACCESSORY COMPONENTS

A continually expanding family of accessory components is offered for the IntelliLogger system. A few of the accessories…

- **PSTN Modem** for communication with the IL over conventional telephone lines
- **Cellular Modems** for communication with the IL over the cellular phone network (GSM/GPRS and CDMA/1xrtt supported).
- **RF Links** for unlicensed spread spectrum communication within plants or to remote locations
- **CF Card** memory for industry standard transportable data storage

FEATURES

Designed with the User in mind, the IntelliLogger instrument has a multitude of integral features ranging from powerful hardware to unlimited software programmability and data review. Key features include:

- BBus Expansion for up to 128 channels of 18+ bit resolution, *isolated* analog input
- Standard Web Page serving… view readings and system status with your browser
- Integrated USB, Ethernet, RS-232 (2) ports
- Configurable Interface Modules accept a multitude of signal types and ranges *all on a single module*.
- Email output for alarms or updates

- Custom Web Page serving… drag and drop Web page designer in HyperWare-II allows for Web page development employing animated objects such as motors, pumps, pipes, thermometers, gauges and graphic images. Build pages showing the process being monitored with embedded real-time values.
- FTP (File Transfer Protocol) data output for periodic automated archiving of logged data to a remote PC running an FTP Server
- Low power design allows for long term field operation from battery
- Programmable Analog outputs for sensor excitation and basic control
- Four digital inputs user programmable for Event, Count and Frequency measurement
- Four integral alarm outputs including two relays
- Integral Compact Flash (CF) card socket for expanded and/or transportable log memory
- HyperNet™ visual icon based programming provides unlimited flexibility in programming, *yet maintains simplicity with drag and drop icon configuration.* Set the IntelliLogger up without writing any cryptic lines of code or experiencing the rigors of excruciating two button menu tree nightmares.
- Intelligent logging methodologies include logging only upon change of an input (Delta-Logging), Conditional logging based on input levels, Conditional logging based on time of day or elapsed time, dual speed logging initiated by User programmed conditions, and more.
- Integral Liquid Crystal Display (LCD) for system status as well as local real-time display of User defined input and/or calculated values and states
- User defined alarm messages
    -
    -

3 INTELLILOGGER SYSTEM BASE

OVERVIEW

The IntelliLogger System Base consists of an anodized aluminum enclosure, which houses the main microprocessor, internal memory, liquid crystal display, user buttons, and all I/O and support circuitry. With the addition of power, user program and sensor connections, the unit is a fully self-contained data acquisition, alarming and Web Page serving system.

MODEL VARIATIONS

The IntelliLogger is provided in several different standard models. The differences between the models lie in their integrated analog input channel count and Interface Module expansion capability. Otherwise the units all support the same feature sets of programmability via HyperWare-II, user interface, communication options and Network features (e.g. Email, FTP, Web Page serving, etc).

Model	Analog Inputs	BBus for Interface Module connection
IL-10	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc	BBus non-functional
IL-20	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc	Functioning BBus for addition of up to 16 ILIM-x Interface Modules
IL-80	Three non-isolated, 10 bit resolution inputs for thermocouple, Vdc and Adc and Eight isolated, 18+ bit resolution inputs for thermocouple, Vdc and Adc (same as ILIM-7)	Functioning BBus for addition of up to 15 additional ILIM-x Interface Modules

Table 3-1; Model Variations

ENCLOSURE AND MOUNTING

The IntelliLogger is housed in a rugged anodized aluminum housing. The housing is not weatherproof, so for deployment in harsh environments one of the housed systems should be considered (Contact Logic Beach about the IL-250, IL-300).

The IntelliLogger can be surface mounted using the IL Mounting Bracket (PN 3539.30010). This flat plate is first fastened to the back of the IntelliLogger using the screws provided with the Mounting Bracket, then mounted to the desired installation surface.

Figure 3-1; Mounting the IntelliLogger

Additional ILIM-x Interface Modules can be fastened in a stair-step method to the bottom of the IntelliLogger. Back mounting of modules in this way requires the use of the Module Mounting Bracket (PN 3539.30000). Two or three modules can be mounted in this fashion.

Figure 3-2; Back Mounting Modules

USER INTERFACE

Various front panel features are built into the IntelliLogger to provide local user interface as well as feedback.

BUTTONS

Located along the left edge of the front panel are five momentary push buttons providing basic IntelliLogger operational control. Details on the button functions follow:

NEXT and SELECT

The NEXT and SELECT buttons are used for User control of the liquid crystal display (LCD) information displays. Pressing NEXT will advance the LCD display to the next menu item at the current menu level. Pressing the SELECT button selects that menu item and a new level of menus or results are displayed.

A detailed explanation of the operation of the NEXT and SELECT buttons is covered in a later section on the Liquid Crystal Display.

ENABLE

The ENABLE button initiates the execution of the current Program Net residing in IntelliLogger memory. Upon pressing the ENABLE button, the LCD will normally change to display ENABLED.

> ***FYI:*** *The label ENABLE was chosen rather than START for a subtle but important reason. When the ENABLE button is pressed, execution of the Program Net commences... but that does not necessarily mean that data logging to memory has started.*
>
> *For example, a Program Net is developed and uploaded to the IntelliLogger that includes a setpoint function that controls logging to memory. For example log only when the kiln temperature exceeds 150F. Pressing the ENABLE button merely causes the IntelliLogger to take readings of the kiln temperature... but logging to memory STARTS when the temperature rises above the 150F threshold.*

STOP

Pressing STOP at any time causes the IntelliLogger to finish sequencing through the currently executing Program Net, then stop executing. The LCD then updates to show *STOPPED*.

RESET

A hardware reset of the IntelliLogger microprocessor can be performed by depressing and releasing both the STOP and RESET buttons at the same time. This normally should not be required but in the event that an extreme noise glitch or some other malfunction occurs, this manual Reset capability is provided to allow user reset of the microprocessor from the front panel.

WATCH-DOG TIMER RESET

A special automatic reset circuit is incorporated into the System Base to add additional reliability to the IntelliLogger system. This circuitry, called a Watch-Dog Timer will force the IntelliLogger microprocessor to reset and continue operation where it left off (within 2 seconds) in the event that an unforeseen hiccup or noise glitch (for example, from a nearby lightning strike) causes the microprocessor to lose its place or lock-up.

Although this circuit normally should not operate, it adds one more level of robustness to the IntelliLogger for handling unforeseen events.

POWER SWITCH

An ON/OFF power switch is provided in the upper right corner of the IntelliLogger. As with an unexpected power failure (e.g. batteries going dead), cycling the power switch off while the IntelliLogger is logging will not result in a loss of data in memory. The IntelliLogger circuitry detects the collapsing supply voltage and quickly closes out all data logging. Upon return of power (either due to cycling the power switch back ON or reconnection of external power, the IntelliLogger will awaken, assess its status prior to the power failure and continue on. If it was logging when a power failure occurred it will commence logging.

STATUS INDICATOR LEDS

Two green LED indicators (labeled *Status*) are located at the center top of the IL front panel. These indicators are under Program Net control and can be programmed by the user for desired visual feedback such as temperature is in bounds, pump is on, etc.

LIQUID CRYSTAL DISPLAY

An extended temperature range 4-line by 20-character liquid crystal display (LCD) is provided. Information ranging from Operational Mode to System Status to Alarm Messages to signal readings can all be displayed on the LCD. The LCD is continually ON. Information to be displayed is controlled by a User via the SELECT and NEXT fronts panel buttons.

Additionally, alarm messages will be automatically displayed on the LCD when User pre-programmed conditions are met or when the IntelliLogger detects system changes. User messages and conditions are defined by the User in the Program Net developed within HyperWare-II and loaded into IntelliLogger memory. Refer to Appendix A (Program Net Palette Icon Reference) for details on programming LCD messages.

Display Operation

Information that can be displayed on the LCD is arranged in a hierarchical format and is accessed by a User via the NEXT and the SELECT buttons on the front panel of the IntelliLogger.

Pressing the NEXT button advances the display to the next available item in that menu level. Repetitive presses of the NEXT button will result in a circular sequencing through all of the available menu items on the current level and eventual repeat of the sequence.

Pressing the SELECT button selects that menu item and a new level of menus or results are displayed.

***TIP** - a basic comprehension of this LCD menu structure can be achieved by close reading of this section... but better results may be achieved by just `diving in' and poking around with the NEXT and SELECT buttons to develop a feel for the structure. .*

Basic Display Hierarchy

The following is a Listing of the LCD menu structure that can be accessed via the *Next* and *Select* buttons.

HOME MENU

When other menus are not manually selected, the Home Display is shown. Information displayed includes the Model, Firmware (internal code) version number and two lines of Operational and Status messages which indicate what tasks the IntelliLogger is currently performing (e.g. Enabled, Downloading data, Stopped, etc).

From the Home Menu, tapping *Next* will advance the display through a sequence of top level menus. At any top-level menu, tapping *Select* will advance the LCD deeper into that particular branch.

From the Home Menu, pressing Next takes you to… in order…

ENTER DATA MARKER

Allows insertion of pre-defined text into the logged data file. This can be useful for noting when changes are made to the IntelliLogger location, sensors, etc such as in a mobile survey application. The text messages are defined within the Program Net prior to deployment

STATUS

Provides a sequence of system information displays including such items as date/time, memory status, Unit Name, supply and backup memory voltages, hardware listing, etc.

PROBE POINT

Allows for viewing (via manual selection or automatic advancement) of current 'Probe Point' values. These Probe Point values are temperatures, pressures, totals, flows, and other actual or calculated analog and digital values that have been previously tagged within the Program Net. Refer to the Probe Point icon within Appendix A (Program Net Palette Icon Reference).

ACTIVE MESSAGES

System and conditional messages (e.g. alarms) can be reviewed within this branch. Custom messages can be developed within the Program Net to display upon events, alarms, warning conditions, etc.

CHANGE ALARM STATES

Allows front panel control of the various hardware outputs in the System Base such as relays, digital output, etc. Via the front panel and LCD, the outputs can be forced ON or OFF as well as returned to Program Net control.

ERASE LOGGED DATA

Allows for front panel erasure of data logged to internal or removable Compact Flash card memory… assuming that the currently executing Program Net has enabled this function.

FORMAT CF CARD

Allows for front panel formatting of a non-formatted Compact Flash memory card… assuming that the Program Net has enabled this function.

INDICATORS

Front panel LED indicators provide feedback on status of relay outputs, Ethernet connection and User defined logic signals within a Program Net. Use of these indicators is detailed in following sections.

POWER AND GROUND CONNECTIONS

The IntelliLogger requires low-voltage (7-30Vdc) external power to operate. Power can be provided from sources such as batteries or the supplied 120Vac to 12Vdc power adapter (PN DCXF-115/12).

Two numbered, 18 position pluggable terminal strips are provided along the right edge of the IntelliLogger with associated labeling on the front panel. Wiring connections can be made with the terminal strip installed or these terminal strips can be unplugged from their mating connector and wiring connections made.

POWER AND GROUND

Power and ground connections are made via the top terminal strip at connections numbered 15 through 17. For installations with a single power source, connect the power source Positive lead to Terminal 17 (Vdc+) and the Negative lead to Terminal 16 (Gnd).

Some applications may have two power sources such as a utility powered wall transformer and a backup battery. For these applications, the wall transformer leads can be connected as mentioned above and the backup battery can be connected with its Positive lead (black and white) to Terminal 15 (Vbatt) and the battery Negative lead (black) to the shared Terminal 16 (Gnd). Refer to Figure 3-3.

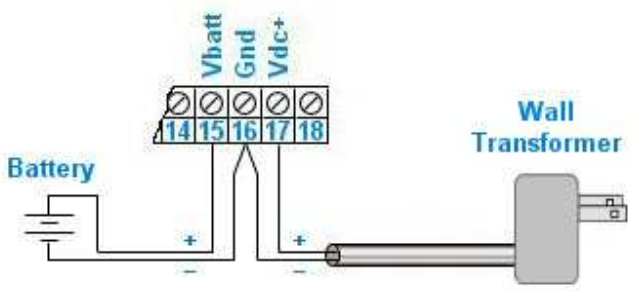


Figure 3-3; Shared External Power Connections

Warning

In shared power supply installations, before making electrical connection to the IntelliLogger insure that the 'ground' of the two power sources can be connected together without problems.

CHASSIS GROUND

For optimum system accuracy and protection of the IntelliLogger from electrostatic discharge damage, it is highly recommended that an Earth ground connection be made to Terminal 18 (ChGnd). Ideally a short wire will be connected from this terminal to a known Earth ground connection such as an electrical panel ground in industrial environments or a ground rod driven 6' into the Earth in outdoor/remote installations. Ensure that the lead does not have excessive length or coils as this adds inductance and lessens the effective protection.

POWER FUSE

An over-current fuse is provided in the System Base and is the topmost fuse visible projecting slightly from the *Fuse and Input Switch Access Cover* which is located in the upper right corner of the System Base (Figure 3-4). To access the fuse, turn IntelliLogger power OFF, and then use a small Phillips screwdriver to remove the two black screws and the cover. To replace the fuse, use your fingers or a pair of small pliers to tug the fuse straight up and out of its socket. The fuse is rated 3A and is a Littelfuse model 273003, which is commercially available via electronic distribution or direct from Logic Beach.

ANALOG INPUTS

The IntelliLogger System Base provides three over-current protected analog inputs with 10 bit bipolar resolution. Signal connections for these analog inputs are made on the top terminal strip at terminal locations 1 through 9 and are labeled on the front cover as AI_A, B and C.

Two of the channels (AI_A and AI_B) are identical and provide a programmable selection of input types and ranges. The third channel (AI_C) can be configured as a fixed current or a fixed voltage channel. Configuration of input signal type is done via the HyperWare-II Program Net programming as (described in Chapter 7) well as via hardware Configuration Switches (described below).

CONFIGURATION SWITCHES

The IntelliLogger System Base analog inputs are individually field configured for current or voltage measurement via a DIP switch setting. This switch is accessed by powering down and then removing the *Fuse and Input Switch Access Cover* (Figure 3-4) in the upper right corner of the IntelliLogger System Base.

To access the switch, turn IntelliLogger power OFF, and then use a small Phillips screwdriver to remove the two black screws and the cover. A DIP switch is then accessible which contains three individual switches… one for each of the three analog input channels. Use a small screwdriver to set the switches to the ON position for current measurements or OFF for voltage measurements.

The top switch sets Channel AI_A, the middle Channel AI_B and the bottom switch is for Channel AI_C.

Figure 3-4; Configuration Switches

Caution

Before adjusting switch settings or changing fuses, ensure that you touch the IntelliLogger enclosure. This will equalize the instrument and your body's electrical potential and minimize the chance of electrostatic discharge (ESD) damage.

Use care in flipping the DIP switches to different positions so that the screwdriver does not slip and gouge the circuit board below.

PROGRAMMABLE INPUT TYPES AND RANGES (CHANNELS AI_A AND AI_B)

Channels AI_A and AI_B feature programmable gain amplifiers resulting in 8 ranges of input. Each of these analog inputs can be individually configured to accept and process signals from J, K, E, T, R and S type thermocouples (Table 3-2) as well as DC voltage and DC currents (Table 3-3).

THERMOCOUPLE TYPES AND RANGES

Type	Color (USA)	Range (F)	Range (C)
J	white/red	-328 to 1832F	-200 to 1000C
K	yellow/red	-454 to 2498F	-270 to 1370C
E	purple/red	-454 to 1832F	-270 to 1000C
T	blue/red	-454 to 752F	-270 to 400C
R	black/red	-58 to 3214F	-50 to 1768C
S	black/red	-58 to 3214F	-50 to 1768C

Table 3-2; Thermocouple input types and ranges

VOLTAGE AND CURRENT RANGES

DC Voltage Input Ranges	DC Current Input Ranges
-10 to +20mV	-100 to +200uA
-35 to +60mV	-350 to +600uA
-45 to +80mV	-450 to +800uA
-60 to +100mV	-0.6 to +1mA
-120 to 200mV	-1.2 to +2mA
-300 to +500mV	-3 to +5mA
-0.6 to +1.0V	-6 to +10mA
-1.2 to +2.0V	-12 to +20mA

Table 3-3; Voltage and Current Ranges

FIXED INPUT TYPE AND RANGE (CHANNEL AI_C)

Channel AI_C is field programmable via the bottom switch for DC current and DC voltage measurement within the ranges of:

Vdc Input: -1.1 to +3.2VDC

Adc Input: -11 to +32mAdc

OVER-CURRENT PROTECTION FUSES

Each of the System Base analog inputs is protected from extreme over-current while in the current measurement mode by a series 100mA fuse. Four fuses are visible protruding through the *Fuse and Input Switch Access Cover*. The bottom three fuses are for the analog input channels (the top fuse is a main power fuse… rated 3A). To replace a fuse, use your fingers or a small pair of pliers to tug the fuse straight up and out of its socket. The fuse is rated 100mA and is a Littelfuse model 273.100, which is commercially available via electronic distributors or direct from Logic Beach.

Additional surge and transient protection circuitry is built into the IntelliLogger power supplies and should not normally require service. The fuse is the only component that is field/user replaceable.

COMMON MODE INPUT RANGE

The three analog inputs on the System Base are not isolated and are referenced to instrument circuit ground via a 20Kohm resistor. This circuit ground is common to other non-isolated I/O on the instrument. For this reason, all signals applied to these inputs must be within +/- 4VDC of instrument circuit ground for normal operation.

ANALOG INPUT PROGRAM NET CONFIGURATION

After the analog inputs are configured for the signal type using the above described hardware settings, the channels can then be further configured via the HyperWare-II software in the building of a Program Net. Program Net development is covered in detail in Chapter 7 (Icon Based Programming).

GPDI; GENERAL PURPOSE DIGITAL INPUTS

The IntelliLogger System Base has four integral General Purpose Digital Inputs that can each be user configured to accept input signals from one of the following types:

- Event - detection of discrete or On/Off type inputs
- Count - high speed pulse train counting
- Frequency - sampled frequency of an input waveform

Configuration of the channels is performed via the HyperWare-II software in the building of a Program Net. Program Net development is covered in detail in Chapter 7 (Icon Based Programming) and in Appendix B (System Base Icon Reference).

Physical connection and signal interface is discussed in the following section.

GPDI INPUT SIGNAL CONNECTIONS

The four digital inputs are labeled as DI_A, B, C and D on the front panel. Input signal pairs (positive and negative) for each of these channels is made to the lower System Base terminal strip. Terminals 7 to 14 accept signal inputs in pairs. The terminals marked with a minus (-) are common and connect directly to circuit ground.

> ***CAUTION:***
>
> *Note that a direct connection exists between the common (-) terminal on all four of the GPDI inputs. For this reason, ensure that signals supplied from different sources are at the same potential on the negative lead.*
>
> *When connecting to multiple event, counter or frequency signal sources sharing a common ground or reference, ensure that the source's ground or reference is connected to the terminal strip `common' terminal to prevent shorting out of the source signal and possible damage to the input.*

SHIELDING

In most applications, use of twisted pair leads is sufficient for GPDI Event and Counter applications and the use of shielded cable for event, counter signals is not necessary due to the input circuitry noise margins.

Frequency inputs are amplified by the IntelliLogger input circuitry. When applying low level input signals (e.g. amplitudes less than ~500mV) in electrically noisy environments, improvements in measurement quality may be seen by the use of shielded cable. In this case, connect the cable shield to the IntelliLogger ChGnd terminal (top terminal strip, terminal 18). The cable shield should then be allowed to float (i.e. no connection made) at the signal source end. Shielded cable use for frequency signals will also minimize cable to cable noise cross-talk to sensitive analog inputs connected to other channels of the IntelliLogger.

GPDI EVENT INPUT APPLICATION

Event inputs on the System Base allow for the recording of the state of an ON/OFF or 'discrete' type input. Configured as an Event input, a channel will accept a powered input signal (ranging from 0 to a maximum of 30VDC) or a contact closure (dry contact) input.

- For powered input signals, the System Base Event function defines signals less than 1VDC as a Low level and greater than 4VDC (30VDC max) as a High level.

- For contact closure type inputs, internal power can optionally be supplied from the Event input channel circuitry via a 51Kohm pull-up resistor. A setting within the Program Net icon allows for user control of this pull-up resistor.
- Channel input impedance is greater than 50Kohm.

GPDI Counter Input Application

The Counter function of the GPDI provides an accumulating total of signal transitions received at its input. This input is well suited to counting pulses from flow meters, power meters, etc.

Configured as a Counter type input, a channel will accept a powered input signal ranging from 0 to a maximum of 30VDC or a contact closure (dry contact) input.

- For powered input signals, the GPDI Counter function defines signals less than 1VDC as a Low level and greater than 4VDC as a High level.
- For contact closure type inputs, internal power (commonly referred to as contact wetting current) can optionally be supplied by the Counter input channel circuitry via a 51Kohm pull-up resistor. A setting within the Program Net icon allows for user enable of this pull-up resistor.
- Channel input impedance is greater than 50Kohm.

When a mechanical switch is the source of the input signal, it is common that the mechanical contacts of the switch will bounce a few times upon closure until they settle into a steady closed state. The GPDI circuitry is fast enough to detect these bounces as many On/Off signals and that signal could be logged as multiple transitions. To filter out this bouncing, a 40mS debounce/filter circuit can be enabled in the Program Net icon, which filters out this contact bounce.

GPDI Frequency Input Application

A GPDI channel configured as a Frequency type input can measure input frequencies ranging from approximately 10Hz to 20KHz. The channel will accurately measure frequencies of sine, square, or sine approximating input waveforms with peak to peak amplitudes of 100mVDC to 30VDC. Channel input impedance is greater than 30Kohm within the specified input range.

For special applications, a voltage pull-up and filtering can be enabled within the GPDI Frequency icon during construction of the Program Net. Typically these settings are not necessary.

+5V Output

A single 5Vdc output is provided on the System Base and can be used for driving loads as well as sensor excitation. The state of this output is under control of the Program Net.

Load Connections

The +5V output connections are on the top terminal strip and are labeled *5V Out*. Terminal 11 is the positive and 10 the negative (IntelliLogger ground).

Output Characteristics

The +5V output provides a good time, temperature and load stable 5VDC output at up to 50mA. The output is current limited and can withstand a load short indefinitely. The output

voltage is fixed at 5VDC (+/- 150mV). A typical variation in output voltage as a function of load is 25mV (over a load range from 1 to 50mA).

For applications requiring reference or excitation voltage stability exceeding this spec (e.g. bridge measurements), the actual output voltage can be sampled using an analog input channel at the time that the excited sensor output is measured. The excitation voltage can then be normalized (i.e. volts of signal per volt of excitation) within the Program Net.

DIGITAL OUTPUTS

Two digital (on/off) outputs are provided on the System Base. The state of these outputs is under software control via the Program Net.

LOAD CONNECTIONS

Connections for these two outputs, labeled *DO_A* and *DO_B* are made on the top terminal strip terminals 12, 13 and 14. Terminal 13 is a shared circuit ground terminal (GND). Output DO_A load should be connected from terminal 14 (+) to 13 (-) and Output DO_B load across terminals 12 (+) and 13 (-).

OUTPUT CHARACTERISTICS

The Digital Output terminals switch between 5VDC and 0VDC under Program Net control. The outputs are short-circuit protected and can be shorted indefinitely without damage. Protection circuitry in series with the outputs limits the drive current and the output voltage will drop as a function of the delivered current. An effective 200 ohm series source resistance can be used for calculation of the supplied voltage for user applications. For example, with a load that draws 5mA of current, the output voltage will be approximately 5V - (0.005 x 200) = 4V

RELAY OUTPUTS

Two 'Form C' relays are provided on the System Base. The state of these relays is under software control via the Program Net.

LOAD CONNECTIONS

Connections for the two relays, labeled RO_A and RO_B are made on the lower terminal strip, terminals 1 through 6. The relay terminals are floating and not connected to internal IntelliLogger power or ground. Each relay has Common (C), Normally Open (NO) and Normally Closed (NC) contacts brought out to the terminal strip.

SWITCHING CAPACITY

The relay switching capacity is 1A ac/dc, 32V maximum.

RELAY ENERGIZED LED INDICATORS

A red LED indicator is provided on the front panel for each of the relays. When the indicator is Off, the relay is not energized and continuity exists between the Com and the NC terminals. When On, continuity exists between the Com and the NO terminals.

ANALOG OUTPUTS

Two voltage sourcing analog outputs are provided on the System Base. The output voltage from these outputs is under software control via the Program Net.

LOAD CONNECTIONS

Connections for these two analog outputs, identified as AO_A and AO_B are on the bottom terminal strip, terminal pairs 17 and 18 (AO_A) and 15 and 16 (AO_B).

OUTPUT CHARACTERISTICS

The analog outputs' voltage range is from 0 to 10Vdc assuming a supply voltage greater than ~10.5Vdc is connected. The output is current limited to ~30mA and can be shorted indefinitely without damage. The 10Vdc is sourced from the unregulated supply voltage. For a full swing to 10Vdc, the voltage powering the IntelliLogger must be approximately 10.5Vdc or greater. In the event that the supply voltage drops below 10.5Vdc, the analog output maximum voltage will be reduced correspondingly.

COMMUNICATION CONNECTIONS

On the bottom end of the IntelliLogger are a variety of communication connectors for RS-232, USB, Ethernet and BBus communications. These connectors are provided for communication between a PC and the IntelliLogger, for network connection, for connection to Interface Modules and for hook-up of external communication equipment such as modems

> *Note:*
> The BBus and Ethernet ports both use the same RJ-45 type connector so always double-check that cables for either communication are plugged into the correct connector!

RS-232 (PC)

The DB-9 Female connector on the right end is dedicated to direct connection and communication with a PC RS-232 serial port. It does not have the full suite of control signals implemented.

RS-232 (COMM)

The DB-9 Male connector supports all of the signals for RS-232 communication. This port is dedicated for connection to external communication devices such as modems and RF transceivers. Contact Logic Beach for the latest offering of supported devices.

USB

A single USB 1.0 compliant port is provided. This 'Type B' port is for direct connection via USB cable to a USB port on a PC.

BBUS

An RJ-45 (8 conductor) connector is provided for daisy-chain connection of additional Interface Modules. A standard CAT5 Ethernet cable should be used for the interconnecting cable. Interface modules have two BBus connectors… allowing for a System Base connection to an Interface Module then out of the Interface Module 2nd BBus port to another Interface Module, etc.

ETHERNET

A 10Base-T Ethernet port is provided for direct connection to a PC (via a crossover cable) or to a hub, router or Ethernet Bridge. This port is typically used to connect the IntelliLogger to a network, allowing remote access via HyperWare-II, Web browser and/or GreenWater.

Two front panel indictors are provided for status and troubleshooting.

- LAN Activity indicator - lights whenever communication packets are sent or received.
- LINK Status indicator - displays steady when a LAN connection is established (i.e. valid link pulses are detected).
-

COMPACT FLASH SOCKET

On the left side of the IntelliLogger, a Compact Flash (CF) card socket is provided. Upon insertion of a CF card, a small ejector lever will project. To remove the card, stop logging (Press Stop) then press on the end of the ejector… and the card will pop out.

The CF card can be used in place of internal memory for storing logged data, which may be able to store considerably more data than possible using internal memory. Details on application of the CF card are provided in Chapter 6 (Communication Window).

4 INTERFACE MODULES

OVERVIEW

To expand the input and output channel capability of the IntelliLogger, one or more Interface Modules can be added to an IL-80 or IL-20 System Base. Additional Interface Modules are added by connecting them in a daisy-chain method to the System Base via the IntelliLogger BBus. Communications and power (for up to approximately 5 modules) is provided by the System Base via the BBus. For systems with more than 5 modules, the optional BBus Power Booster (BPB-1) can be used. The BPB-1 injects additional current into the BBus allowing for greater than 5 modules to be BBus networked.

BBUS INTERCONNECT

The BBus is a serial data link for communication between the IntelliLogger System Base and one or more Interface Module(s). In addition to communication, it also provides a limited amount of power for powering up to approximately 5 modules.

Modules that are connected on the BBus must be assigned unique Addresses such that communications can be routed correctly.

> ***Note:*** *The IntelliLogger model IL-10… although equipped with a BBus physical connector does not have BBus communication capability.*

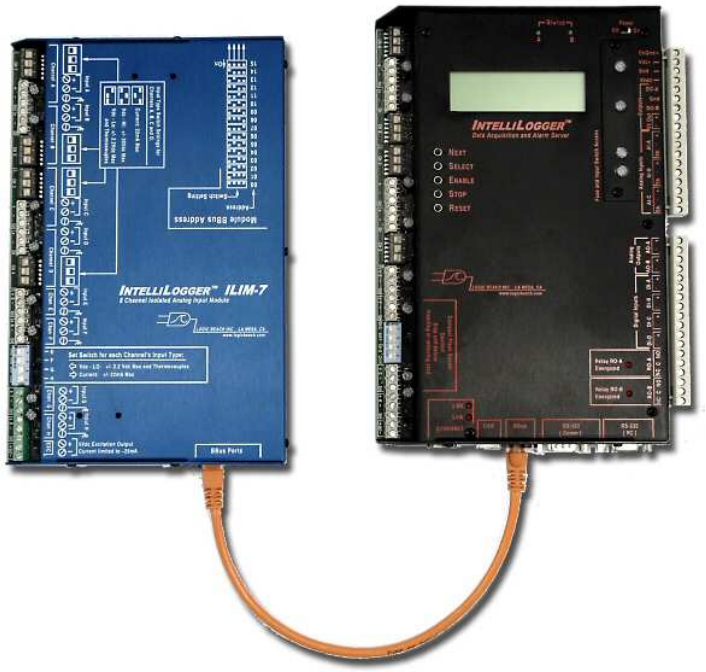


Figure 4-1; IL-80 shown with BBus connected external ILIM-7 Module

INTERNAL ILIM-7 INTERFACE MODULE

The IntelliLogger model IL-80 has an ILIM-7 Interface Module packaged into the System Base. Although the module is in the same enclosure as the System Base, it still utilizes the BBus

interconnection scheme although the physical connection is inside the enclosure rather than outside via a BBus cable.

The internal ILIM-7 within the IL-80 has its address pre-set to '00'.

External Interface Modules

The IntelliLogger model IL-80 and IL-20 have active BBus connectors and additional Interface Modules can be connected to increase the input/output capability.

Interconnect Cabling

The BBus interconnecting cable starts at the System Base BBus connector (Figure 4-1) and daisy chains to up to a total of 16 BBus modules. Each Interface Module has two BBus connectors at the bottom end (Figure 4-2). The cable runs into one then out of the other and on to the next module.

Figure 4-2; BBus Interface Module Connection Ports

CAT5 or better cable should be used for BBus connections. This cable is the same cable used for Ethernet based networks and is readily available from most computer stores as well as from Logic Beach.

The last module in IntelliLogger deployments with long BBus runs should have a BBus terminator plugged into the second BBus connector. This terminator serves to minimize signal distortion.

Module Address

Each module that is connected onto the BBus must have a unique Address such that all channels will be uniquely identified. The address is defined by configuration of the Module BBus Address DIP switch (Figure 4-3) which is accessible at the top end of the module. 16 unique addresses can be set by the combination of the 4 switches integral in the DIP Address switch.

As shown in Figure 4-3, all switches in the OFF position indicates an address of 00 and all switches ON sets the address to 15. The actual address used is not critical, just ensure that each module on the BBus has a unique address.

Note: The ILIM-7 packaged in the IL-80 System Base always has an address of 00 and can not be changed. Insure all external Interface Modules on an IL-80 BBus network are set to addresses other than 00.

Figure 4-3; Interface Module Address Setting Switch

Once all of the Interface Modules have unique ID's set, a quick check can be done via the IntelliLogger front panel LCD.

1. From the top menu, use *NEXT* to step to the *Status Menu*
2. Push *Select* to enter into the Status section, then *NEXT* repetitively until the *Installed Hardware* menu appears.
3. Press *SELECT* and a display of the installed Interface Modules will list with their addresses.

Alternatively, if a PC serial connection exists, upon connection to the IntelliLogger, the installed and correctly addressed Interface Modules will display graphically around the IntelliLogger. Clicking on any of the graphics representing modules will result in an informational dialog (Figure 4-4) showing the module type, address, Serial Number, Firmware version (if the module includes a microcontroller) and more. Additionally, a name can be assigned to the module from this dialog.

REFLASH FIRMWARE

To update firmware (reflash) through HyperWare, click the "Reflash…" button next to the firmware version in the "Module Properties" dialog. This will bring up a standard open dialog that will allow the user to navigate to the new firmware file and open it to begin the reflash.

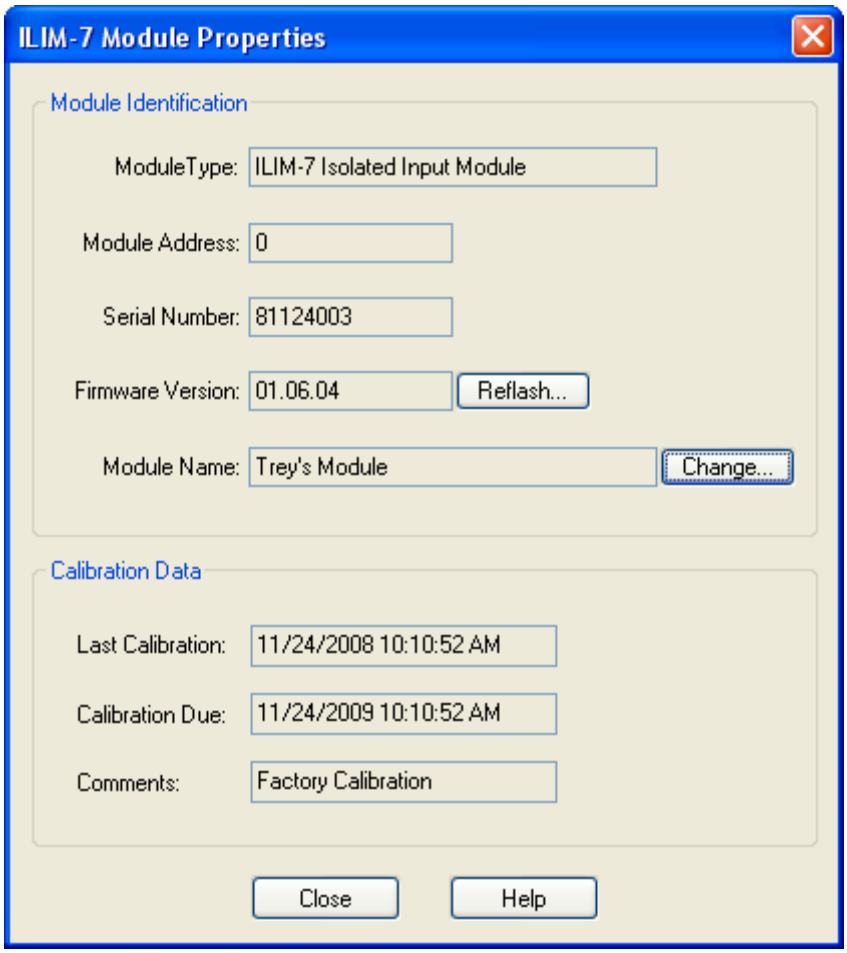


Figure 4-4; Interface Module Properties Dialog

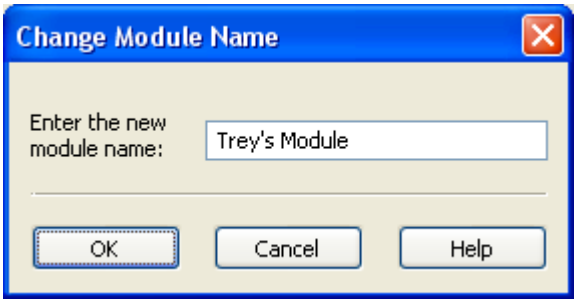


Figure 4-5; Change Module Name Dialog

MODULE NAME

To change the name given to a particular module click the “Change…” button next to the module name in the “Module Properties” dialog to open the “Change Module Name” dialog.

BBUS POWER BOOSTER (BPB-1)

The BPB-1 is an optional device that can be used to inject additional power to the BBus for applications utilizing more than approximately five Interface Modules, as the system base can’t source enough power. The BPB-1 has two BBus connectors (in and out) and is daisy-chained in a BBus network just like an Interface Module. The BPB-1gets power from a plug-in wall adapter or external battery source. Contact Logic Beach for additional information.

ILIM-7; ISOLATED ANALOG INPUT MODULE

The ILIM-7 is one of the family of IntelliLogger Interface Modules (Figure 4-6) that provides 8 *isolated* analog inputs as well as a 5Vdc output for sensor excitation. Each of the inputs is field programmable for thermocouple, Vdc and mAdc input. The input channels are all isolated, channel to channel as well as channel to System Base by 200Vac.

CAUTION

Although the channels provide electrical isolation up to 200 Vac, the IntelliLogger and accessories including the ILIM-7 module are designed for use only with Class-2 (30Vdc) voltages and the inputs should not be connected to any high voltage sources as potentially lethal injury could result.

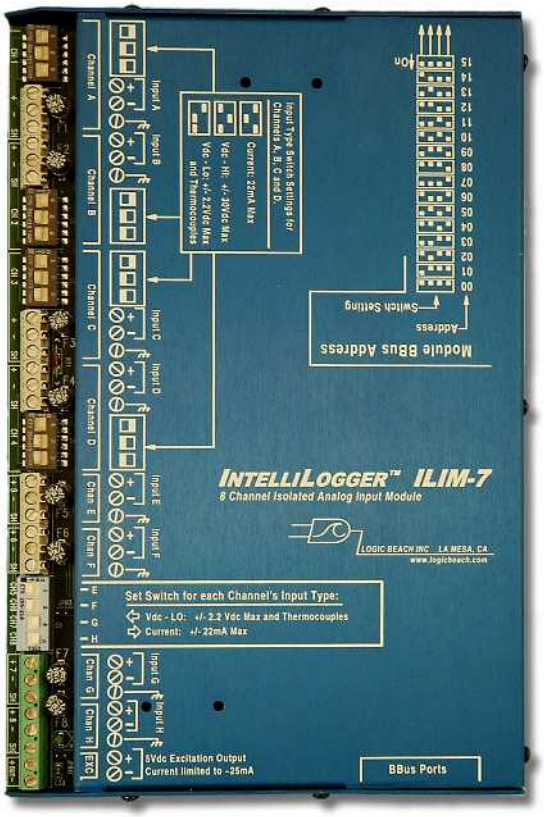


Figure 4-6; ILIM-7 Isolated Analog Input BBus Connected Module

INTERNAL VS STAND-ALONE EXTERNAL ILIM-7 MODULES

The ILIM-7 can be provided in IntelliLogger systems in two different package formats:

Stand-Alone External Module:

As shown in Figure 4-6, the ILIM-7 can be provided as a stand-alone module that is connected to the IntelliLogger System Base via a BBus cable. This package has optional mounting hardware to allow it to be surface mounted using the Surface Mounting Bracket (PN 3539.30010) or alternatively for attachment to the

back of an IntelliLogger System Base using the Stair-Step Mounting Bracket (PN 3539.30000).

System Base Integrated Module:

As shown in Figure 4-7, the ILIM-7 is alternatively supplied integrated into the IntelliLogger System Base in the IntelliLogger model number IL-80. The function of the Integrated Module is identical to that of the External Module, however the BBus connection between the IntelliLogger System Base and the ILIM-7 assembly is done internally.

Figure 4-7; IL-80 with Integrated ILIM-7 Module

As an IL-80 integrated module, screen-printing is not provided on the front of the System Base detailing Channel and wiring connections. Markings are provided on the actual printed circuit board and in conjunction with the following wiring diagram (Figure 4-8) proper connection points can be identified.

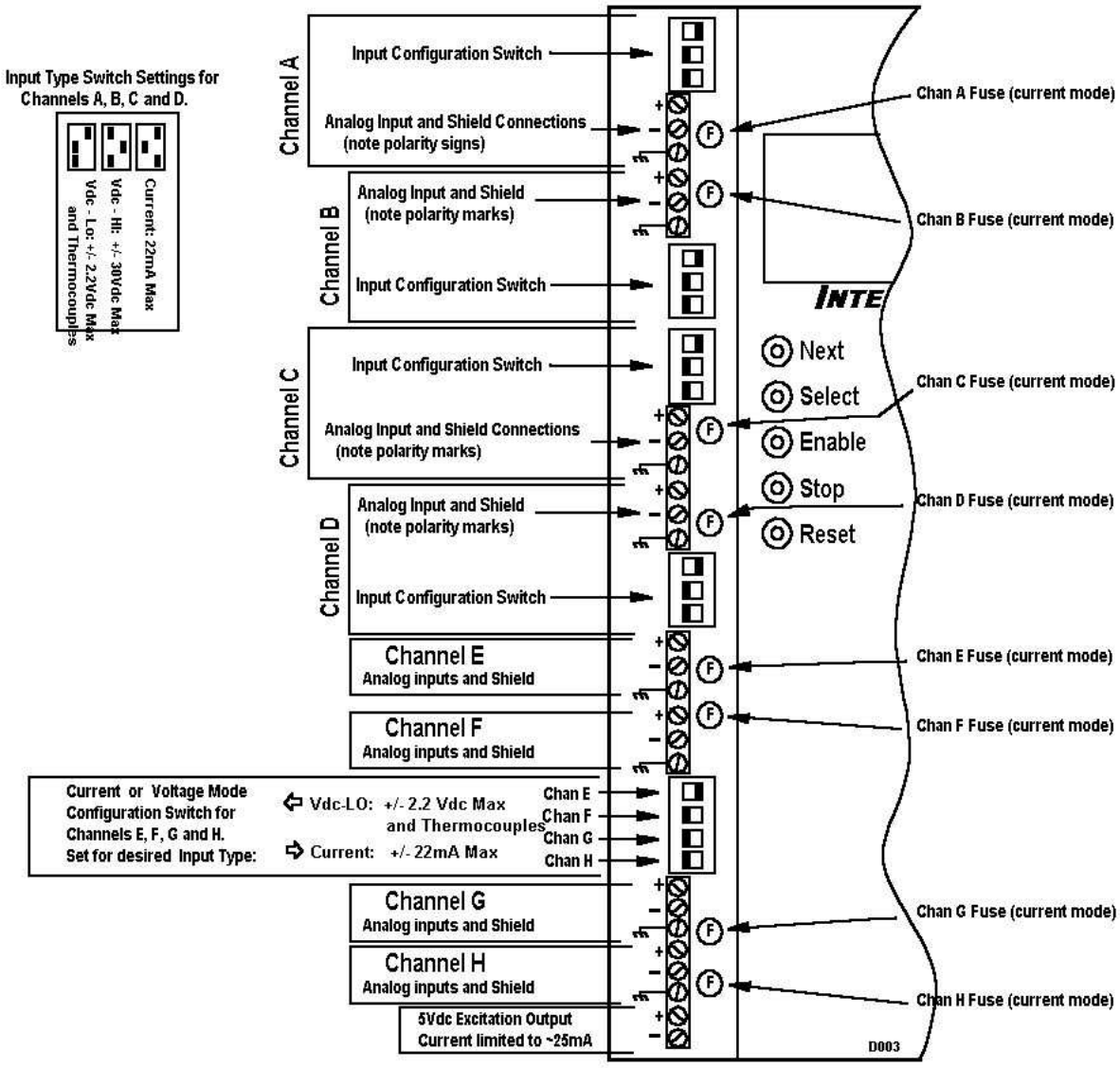

Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - Hi: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Channel A
Input Configuration Switch
Analog Input and Shield Connections (note polarity signs)
Channel B
Analog Input and Shield (note polarity marks)
Input Configuration Switch
Channel C
Input Configuration Switch
Analog Input and Shield Connections (note polarity marks)
Channel D
Analog Input and Shield (note polarity marks)
Input Configuration Switch
Channel E
Analog inputs and Shield
Channel F
Analog inputs and Shield
Current or Voltage Mode Configuration Switch for Channels E, F, G and H. Set for desired Input Type:
Vdc-LO: +/- 2.2 Vdc Max and Thermocouples
Current: +/- 22mA Max
Chan E
Chan F
Chan G
Chan H
Channel G
Analog inputs and Shield
Channel H
Analog inputs and Shield
5Vdc Excitation Output Current limited to ~25mA
Chan A Fuse (current mode)
Chan B Fuse (current mode)
Next
Select
Enable
Stop
Reset
Chan C Fuse (current mode)
Chan D Fuse (current mode)
Chan E Fuse (current mode)
Chan F Fuse (current mode)
Chan G Fuse (current mode)
Chan H Fuse (current mode)
D003

Figure 4-8; Integrated ILIM-7 Configuration Switches and Wiring Connections

ANALOG INPUTS

Eight bipolar analog inputs are provided on the ILIM-7 and are identified as Channels A through H. All eight channels are identical in range and input type offering with the exception that the first four channels (A through D) offer an additional range (Vdc-Hi) that allows for direct connection of Vdc signals up to +/-30Vdc.

Analog input channels are configured for current or voltage/thermocouple via a DIP switch setting on a channel by channel basis. Within each input type, multiple full-scale ranges are offered and specified via the HyperWare-II Program Net setup.

Input Types

The following inputs can be connected to the ILIM-7. Input ranges are specified in Appendix D (ILIM-7 Module Icon Reference).

THERMOCOUPLE
J, K, E, T, R and S type thermocouples can be directly connected to the ILIM-7 inputs. Cold junction compensation is handled automatically on board such that thermocouple readings read by the System Base are compensated for ILIM-7 ambient temperature.

VDC-HI
Input channels A through D offer a bipolar Vdc-Hi input type that allow for direct connection of signals up to +/-30VDC. As a Vdc-Hi input, 3 sub-ranges can be selected via the HyperWare-II software channel settings.

VDC-LO
All eight input channels offer bipolar Vdc-Lo input that allows for direct connection for signals up to +/-2.2Vdc. As a Vdc-Lo input, 8 sub-ranges (ranging down to +/-19mV) can be selected via the HyperWare-II software channel settings.

CURRENT
All eight input channels offer bipolar mAdc input that allows for direct connection for signals up to +/-22 mAdc. As a current input, 8 sub-ranges (ranging down to +/-190uA) can be selected via the HyperWare-II software channel settings.

Configuration Switches

Channels A through D have a 3 switch DIP switch associated with each channel (Figure 4-8). The combination of these 3 switches On/Off states sets the Input Type per the switch setting pattern table shown in the upper left corner of Figure 4-8 or the following table:

Input Application	SW 1	SW2	SW3
Thermocouple or Low-Level Vdc (2.2Vdc or less)	ON	OFF	OFF
Vdc-Hi; Up to +/- 30Vdc	OFF	ON	OFF
DC Current; Up to 22mA	ON	OFF	ON

Table 4-1; Channel A, B, C and D Input Configuration Switch Settings

The schematic representation of these four input channels is shown in Figure 4-9.

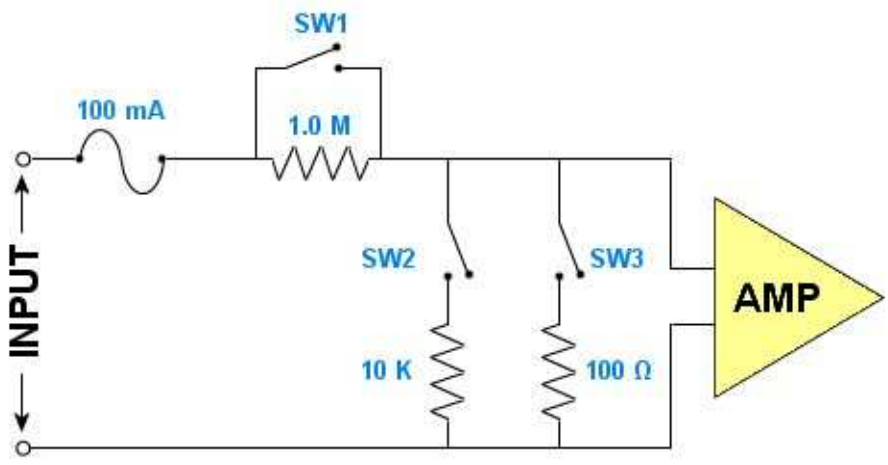


Figure 4-9; Simplified Input Schematic for Channels A, B, C and D

Channels E through H share a single 4 way DIP switch. Each of the 4 switches is associated with one of the channels. The On/Off state of each of the individual switches sets that channel for Current or Vdc/thermocouple use.

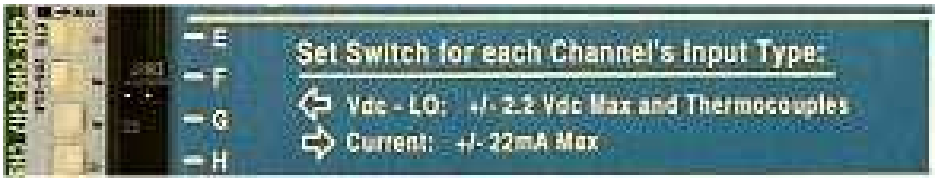


Figure 4-10; Channels E to H Switch Settings

The schematic representation of channels E through H is slightly different than the schematic for Channels A to D and is shown in Figure 4-11.

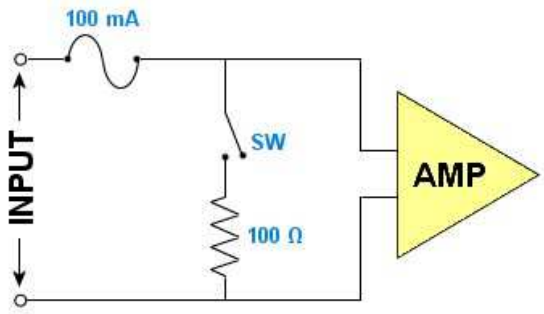


Figure 4-11; Simplified Input Schematic for Channels E, F, G and D nd H

ILIM-7 Channel Configuration Via HyperWare-II

When an ILIM-7 channel is configured as a particular type of input via the module configuration switches, the configuration will be automatically detected by the connected IntelliLogger upon power-up. This channel type information is then communicated to the PC running HyperWare-II and icons representing the currently configured channel type will be available for use during the development of a Program Net. Software input range configuration and utilization of the ILIM-7's channels in a Program Net is covered in Appendix D (ILIM-7 Module Icon Reference).

Input Over-current Protection Fuses

Each of the eight input channels is protected by a 100mA fuse as shown in Figure 4-8 (physical location on module). This fuse will protect the module channel from over-current surges received from malfunctioning or improperly connected sensors and 4-20mA transmitters.

In the event that a channel on a module stops responding with proper values, it may be an indication that this protective fuse has blown. The fuse can be removed from the circuit and checked for continuity with an ohm-meter and/or replaced with a Littelfuse P/N: 273.100 fuse available from Logic Beach Incorporated or many electronic distributors.

To remove the fuse, grasp it gently with your fingers or a small set of pliers and pull straight up to extract it from its white socket base.

Commonly, this fuse is blown during installation of 4-20mA current channels where the power supply powering the 4-20mA transmitter is accidentally shorted directly across the logger input channel. To avoid this inconvenience, always check wiring prior to powering up system power supplies.

Thermocouple Applications

Following are guidelines for connecting thermocouple type inputs to the ILIM-7 input channel terminal connectors.

THERMOCOUPLE CONNECTION

To utilize an ILIM-7 channel as a thermocouple input, configure that channel's Input Configuration Switch as explained earlier in this chapter.

Channels configured as thermocouple inputs utilize two or three terminal strip connections per input; a Positive lead, and a Negative lead and optionally a shield.

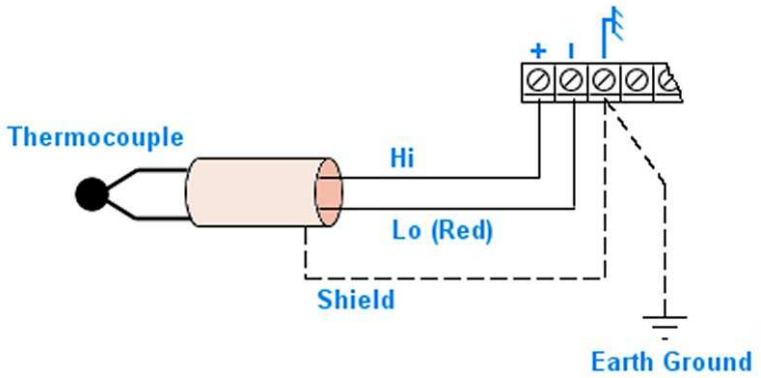


Figure 4-12; Thermocouple (and optional shield) terminal strip connection

Connect the thermocouple positive and negative (red in USA) leads to the correct pair of terminals on the module terminal strip. Polarity markings are printed on the circuit board next to the terminal strip. Polarity is critical, as reverse connected thermocouples will log positive temperatures as negative temperatures.

Shielded thermocouple wire is recommended in electrically noisy environments for optimum signal protection. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the thermocouple shield and shunt it to Earth ground. Note that for the Shield to be effective a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

COLD JUNCTION COMPENSATION (CJC):

For thermocouple measurements, the temperature of the terminal strip connections is required in the voltage to temperature conversion equation used by the IntelliLogger. This temperature is measured by the CJC sensor located internal to the ILIM-7 module. Any differential temperature from the metal terminal strip connections to the CJC sensor on the ILIM-7 circuit board will result in direct measurement errors.

The ILIM-7 is thermally designed to provide good CJC sensor vs. terminal strip temperature tracking however, to minimize this potential error, avoid installations or effects that will induce extreme temperature differential. The most accurate readings will be achieved when the ILIM-7 module has been allowed to temperature stabilize. In rapidly changing temperature environments, additional accuracy can be achieved if the ILIM-7 is housed within another enclosure, which will provide better temperature uniformity throughout the system.

Vdc-Lo Applications

All of the ILIM-7 input channels can be configured for low-level Vdc input per the switch settings shown in Table 1-1. The configuration switch settings to configure a channel as a Vdc-Lo input are the same as the setting when using the channel as a thermocouple input channel. The selection of thermocouple or Vdc-Lo as well as selection of sub-ranges is performed from within HyperWare-II in the input icon Configuration dialog. Clicking a button within the dialog swaps the channel function.

For best accuracy and absolute resolution, utilize the lowest range possible that will cover the input signal's dynamic range without over-ranging.

SIGNAL WIRING CONNECTION:

Interface Module channels configured as VDC inputs provide three terminal strip connections per input; a Positive lead, and a Negative lead and a Shield connection.

Connect the VDC signal positive and negative leads to the correct pair of terminals on the module terminal strip (Figure 4-8). Observe polarity or the output signal will be reversed.

Shielded and/or twisted pair wire is recommended in electrically noisy environments for optimum signal protection. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the thermocouple shield and shunt it to Earth ground. Note that for the Shield to be effective, a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

Shielded wire minimizes the amount of noise picked up by the internal conductors carrying the signals by providing an `electrical shell' or Faraday cage around the internal conductors.

Twisted pair wiring exposes both conductors equally to the ambient electrical noise. This common-mode type noise is easier to reject by the Interface Modules input signal conditioning circuitry than unbalanced (or differential) noise.

Vdc-Hi Applications

Channels A through D have additional input range capability in that they can be field configured to directly accept up to +/-30Vdc. Vdc-Hi Input Configuration Switch setting (Table 1-1) enables a front end precision voltage divider circuit which expands the channel's acceptable input range. Correction for the precision front-end resistor divider is handled automatically and transparently by the ILIM-7 so no user scaling for the divider is required.

Selection of a sub-range is performed within the HyperWare-II Icon Configuration dialog for that channel.

For best accuracy and absolute resolution, utilize the lowest range possible that will cover the input signal's dynamic range without over-ranging.

SIGNAL WIRING CONNECTION:
Interface Module channels configured as VDC inputs provide three terminal strip connections per input; a Positive lead, and a Negative lead and a Shield connection.

Connect the VDC signal positive and negative leads to the correct pair of terminals on the module terminal strip (Figure 4-8). Observe polarity or the output signal will be reversed.

Shielded and/or twisted pair wire is recommended in electrically noisy environments for optimum signal protection. If shielded wire is used, the shield should be connected to the terminal marked 'SH'. The Shield serves to conduct away electrical noise picked up by the thermocouple shield and shunt it to Earth ground. Note that for the Shield to be effective, a wire should be connected from any of the Shield connections on the ILIM-7 terminal strip and then to a known Earth ground. All Shield connections on the terminal strip are interconnected so a single Earth ground connection suffices.

Shielded wire minimizes the amount of noise picked up by the internal conductors carrying the signals by providing an `electrical shell' or Faraday cage around the internal conductors.

Twisted pair wiring exposes both conductors equally to the ambient electrical noise. This common-mode type noise is easier to reject by the Interface Modules input signal conditioning circuitry than unbalanced (or differential) noise.

mAdc Application

All of the ILIM-7 input channels can be configured to accept direct current milliAmp current inputs. Switch setting (Table 1-1) enables a front end precision 100 ohm 'burden' resistor current shunt (and fuse) in the circuit which allows the channel to measure the dc current up to +/-22mAdc. Many sub-ranges can be selected via the HyperWare-II Icon Configuration dialog to allow measurement into uAdc.

Due to the isolation offered by the ILIM-7 module, current measurements (e.g. 4-20mA process loop signals) can be readily made on loops with separate power supplies or at different potentials.

MA SIGNAL WIRING CONNECTION:
Interface Module channels configured as mAdc inputs typically will only use two of the three provided terminal strip connections.

Connect the mAdc signal positive and negative leads to the correct pair of terminals on the module terminal strip (Figure 4-8). Observe polarity or the output signal will be reversed.

CURRENT PROTECTION FUSE
Each channel is protected from permanent damage due to over-current via an inline fuse. In the event that a signal can not be discerned on a channel configured as a current input, it may be that the fuse is blown.

Refer to the section earlier in this chapter titled *Input Over-Current Protection Fuses* for details on the fuse function and replacement.

EXCITATION OUTPUT

The ILIM-7 is equipped with a semi-regulated 5Vdc output that can be used as an excitation source for many sensors requiring excitation (e.g. strain gauge bridge pressure sensors or load cells). The excitation output voltage is cycled on prior to a channel reading for a period of time then a channel reading is taken and the excitation supply is turned off.

Output Characteristics

The Excitation Output is derived from the regulated 5Vdc system voltage on the ILIM-7. The output is controlled via a series transistor, which results in a bit of voltage drop, resulting in an output voltage of approximately 4.8 to 4.9Vdc actual output.

Additionally, the output incorporates over-current protection circuitry that starts reducing the voltage when the load current draw exceeds approximately 25mA. Figure 4-13 shows an output voltage vs. current plot.

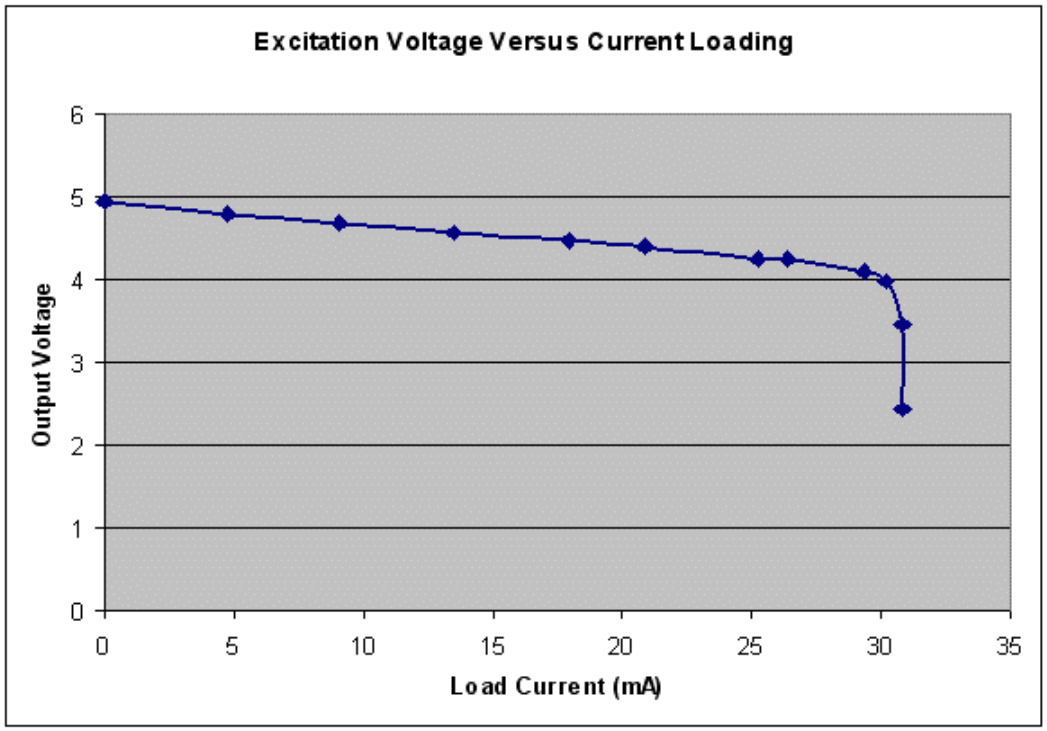


Figure 4-13; Excitation Voltage vs. Current Loading

For many sensor excitation applications, the output voltage can be measured once with a voltage meter and this value can be used in any signal derivation equations that are a function of the excitation voltage (e.g. bridge signals). For applications requiring a precision known voltage supply, one of the ILIM-7 channels can be dedicated to reading the Excitation Output actual voltage and another channel can be dedicated to reading the bridge signal output. Within the Program Net, a Math icon can then be used to normalize the output signal as a function of the Excitation voltage[1].

Current Limit Over-ride Jumper

The 25mA nominal over-current protection circuit can be bypassed with installation of a jumper across the two pins marked 'JPR11' which are located right behind the terminal strip connections for the Excitation Output. Caution must be exercised if using the over-ride jumper as excessive current draw can

[1] For example, dividing the measured output signal (Vsignal) from a strain gauge bridge by the measured Excitation Output voltage, Vexc will result in a normalized mV of signal per V of excitation. This normalized value can then be used for the Engineering units calculation associated with that sensor.

cause permanent damage to the power supply section of the ILIM-7 necessitating factory repair.

In a lightly loaded BBus application, it is possible to draw up to approximately 50mA from the Excitation Outputs for momentary sensor excitation without permanent damage. Contact Logic Beach for assistance.

Excitation Output Enable

If enabled by the user, the Excitation Output cycles on for a period of time prior to an ILIM-7 analog input channel taking a reading, then automatically cycles OFF after the reading is complete. Use of the Excitation Output can be enabled for use on a channel by channel basis. Within the Configuration Dialog[2] for each of the ILIM-7 input channels, there is a checkbox called *Enable Excitation During Reading*. Checking this box will enable operation.

Excitation Output On-Time Extension

The duration that the Excitation Output voltage is ON prior to the actual reading being taken by an ILIM-7 input channel is user programmable for analog inputs that are configured as Vdc-Lo or Thermocouple input types.

Within the Configuration Dialog on Vdc-Lo or thermocouple channels, there is an additional checkbox titled *Extend Settling/Excitation Time* and an associated drop-down list box that allows the user to specify the additional settling time to be added to the default time. For sensors that require 'warm-up' or longer stabilization times after power-up, this feature in most cases can meet the requirements in that up to approximately 2 additional seconds (1992mS) can be specified.

Note that adding Excitation time will slow down the sampling throughput of the IntelliLogger system as the additional Excitation time will delay the advance of the Program Net.

Connections

Two terminal strip connections at the bottom end of the module provide the Excitation Output voltage. The terminals are marked with positive and negative marks.

BBUS CONNECTION

The standard BBus Port connector pair is located at the bottom end of the ILIM-7. Both ports are identical and connections can be made to either. Two ports are provided so that multiple modules can be daisy-chained together (Figure 4-2).

On the ILIM-7, the Module BBus Address is set via the four way DIP switch at the top of the unit. Any addresses can be used, however insure that the same address is not assigned to multiple modules.

> **NOTE:** The ILIM-7 module integrated into an IL-80 System Base is factory assigned the address 00. When configuring an IntelliLogger system with additional external modules, insure that address 00 is not assigned to any of the external modules.

The assigned addresses of BBus connected modules can be checked in a number of different ways via HyperWare-II and a connected IntelliLogger system:

[2] Details on configuring input channels via HyperWare-II are discussed in Appendix D.

- Upon establishing a connection graphics representing the BBus connected modules will display surrounding the IntelliLogger graphic.
- via a Status Query from within HyperWare-II, a listing will display showing the connected modules
- From within the Programming window, connect on the *New* button and then open the Global Icon. Tabs will exist for each of the BBus connected modules.

MOUNTING

With various mounting kits available from Logic Beach, the ILIM-7 can be surface mounted to a wall or attached in a stair-step fashion onto the back of an IL-20 or IL-80 System Base.

SURFACE MOUNTING

An optional Surface Mounting Plate (Logic Beach Part Number 3539.30010) can be attached (Figure 4-14) to the back of the ILIM-7 with four flat-head 4-40 x 3/8" machine screws (provided with Mounting Plate kit). The ILIM-7 can then be mounted to a wall or other flat surface with the mounting holes.

Figure 4-14; ILIM-7 With Surface Mounting Plate

MODULE STACKING

One or more ILIM-7 modules can be attached to the back of an ILIM-20 or ILIM-80 (Figure 4-15) in a stair-step fashion using the Module Mounting Angle Bracket Kit (Logic Beach Part Number 3539.30000).

Figure 4-15; IL20 or IL80 with Attached ILIM-7 Module

Additionally, multiple ILIM-7 modules can be fastened together then wall or surface mounted using the Angle Bracket Kit to attach the modules together then the Surface Mounting Plate (above) to attach the stack to the wall.

To attach an ILIM-7 onto the back of an IL-80…

1. Remove the cover from the ILIM-7 by removing the two black screws on each end of the module and the three screws on the right edge of the module.

2. Using two of the four screws provided with the Module Mounting Angle Bracket Kit, attach the angle bracket to the back of the IntelliLogger (Figure 4-16)

Figure 4-16; Module Mounting Angle Bracket

3. Using two of the four screws provided, attach the face of the ILIM-7 to the back of the IL-80 (Figure 4-17). Note that four holes are provided in the face of the ILIM-7. Two are aligned for use in mounting the ILIM-7 to an IL-80 and the other two are aligned for use in mounting the ILIM-7 to an IL-20.

Figure 4-17; Mounting ILIM Faceplate to IL Base

4. Re-assembly of the ILIM-7: Align the ILIM-7 bottom to the angle bracket and the ILIM-7 top and reinstall the 2 screws on the top and bottom ends of the ILIM-7. Then, install the 3 screws through the angle bracket, the ILIM-7 top and the ILIM-7. It is best to install all of the screws loosely then tighten after all screws have been started.

5 SOFTWARE INTRODUCTION

HYPERWARE-II OVERVIEW

Included with the IntelliLogger is HyperWare-II™, a multi-function Windows™ based software application. HyperWare-II is used for communications, programming, real-time trending, custom Web page construction, data download and file conversion with the IntelliLogger.

HYPERWARE-II FEATURES

- **Communications** support for Ethernet, USB, RS-232, cellular and PSTN modem connectivity provides users many options for local and remote communication with the IntelliLogger. Simple graphic driven communications commands allow for quick status checks, viewing of instantaneous signal and calculated values and alarms, data downloads and more.

- **Icon Based Programming** of the IntelliLogger is intuitively performed by simply dragging, dropping and interconnecting graphic icons to build a Program Net. This Program Net is then uploaded to the IntelliLogger's memory where it executes.
  Icon based programming allows for quick construction of Program Net that perform simple to complex data logging and alarming strategies. Functions include conditional input sampling, mathematical calculations, setpoint alarming and basic control, statistical data reduction, Email of alarm messages and substantiating data, FTP of log data, SMS message transmission and much more.

- **Real-Time Trending** display of sampled and calculated signals, alarm states, and conditions. Custom displays can be quickly and simply built using a full palette of graphic objects including thermometers, bar charts, gauges, tank levels, pumps, pipes, digital and analog displays, line plots, scrolling numeric charts and much more. Once again, simple drag and drop allows for intuitive construction of a full-featured graphic annunciator panel that can graphically represent a piece of equipment, a process or a plant.

- **Custom Web Page development**… all done with icon based drag and drop ease. As with the Real-Time Trending, built a graphic representation of a process, equipment or a plant, embed actual sampled values (pressures, temperatures, totals, etc) and the IntelliLogger can then serve it up on the Web… without a connected PC.

- **Logged Data Download** and conversion to various formats for analysis.

- **Graphic Plotting of Downloaded data** using the integral multi-channel plotter.

Each of the features mentioned above are described in detail in the following HyperWare-II Chapters.

HYPERWARE-II INSTALLATION

HyperWare-II is installed from the provided CD as is most other Windows software. Insert the CD into a drive and follow the prompts. If installation does not start automatically, from the Start menu, select Run then browse to Setup.exe.

Included on the disk is a Readme.txt file that includes an explanation of the installed applications as well as other CD content.

Major installed applications include:

HYPERWARE-II

The main HyperWare-II application used for programming, communication, etc with the IntelliLogger.

GREENWATER™

GreenWater is a Web browser developed by Logic Beach to view custom web pages designed in HyperWare-II, loaded in and served by an IntelliLogger. GreenWater software also includes the graphic objects used by the IntelliLogger for custom web pages. Including the objects with GreenWater places the object on the users PC and increases the speed at which custom web pages load and are presented.

GreenWater can be freely distributed to individuals needing to view or download data from an IntelliLogger and not requiring programming capabilities.

GreenWater is also available via download here: www.logicbeach.com/greenwater/

TRAINING VIDEOS

Included on CD are a number of Logic Beach Inc. created training videos. The videos are avi files recorded with a screen size slightly larger than 800 x 600 pixels and use Microsoft Media Player for viewing. You do not have to copy the avi movies to your hard drive, however, better playback may result depending upon the performance of your computer. For best viewing expand the Media Player screen so the HyperWare-II screen is 1 to 1.

Playback System Requirements:

Microsoft Media Player Download at URL:

http://www.microsoft.com/windows/windowsmedia/default.aspx

Soundcard with speakers

CD Drive

It is suggested to watch the movies in the following order:

Communications.avi

Programming.avi

Realtime Viewing.avi

WebPageCreation.avi

This is an excellent way to accelerate your learning curve. Total training time is about 35 minutes.

HYPERWARE-II ORGANIZATION

HyperWare-II is organized into several windows, each dedicated to a particular function such as communications, programming, trending, etc. The main windows are shown below:

COMMUNICATION WINDOW

Within this window, icons are dragged and dropped between the graphic PC and IntelliLogger to effect commands such as downloading data, uploading a Program Net from the PC to the IntelliLogger memory, checking the IntelliLogger status, viewing instantaneous values and more.

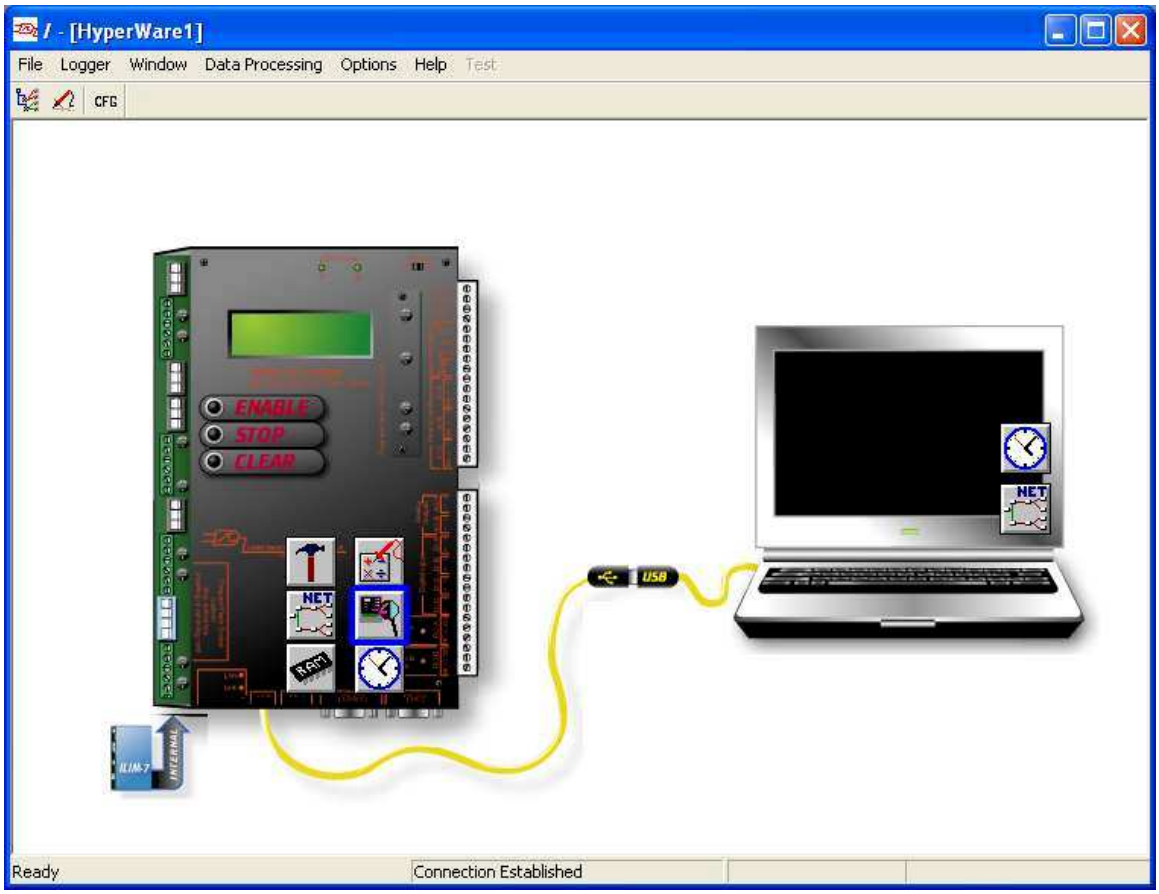


Figure 5-1; Communication Window

NET PROGRAMMING WINDOW

Within this window, programs consisting of a graphic network of interconnected icons called Program Nets are developed. The Program Nets are built by dragging various icons off of the Icon Palette and interconnecting them with a mouse to other icons representing hardware inputs and outputs. Each of the icons is then further configured (names, units conversion, ranges, math, set point settings, etc) by clicking on the icon to open a settings dialog.

Once the Program Net is complete it can be saved to disk as well as uploaded to the IntelliLogger memory where it executes.

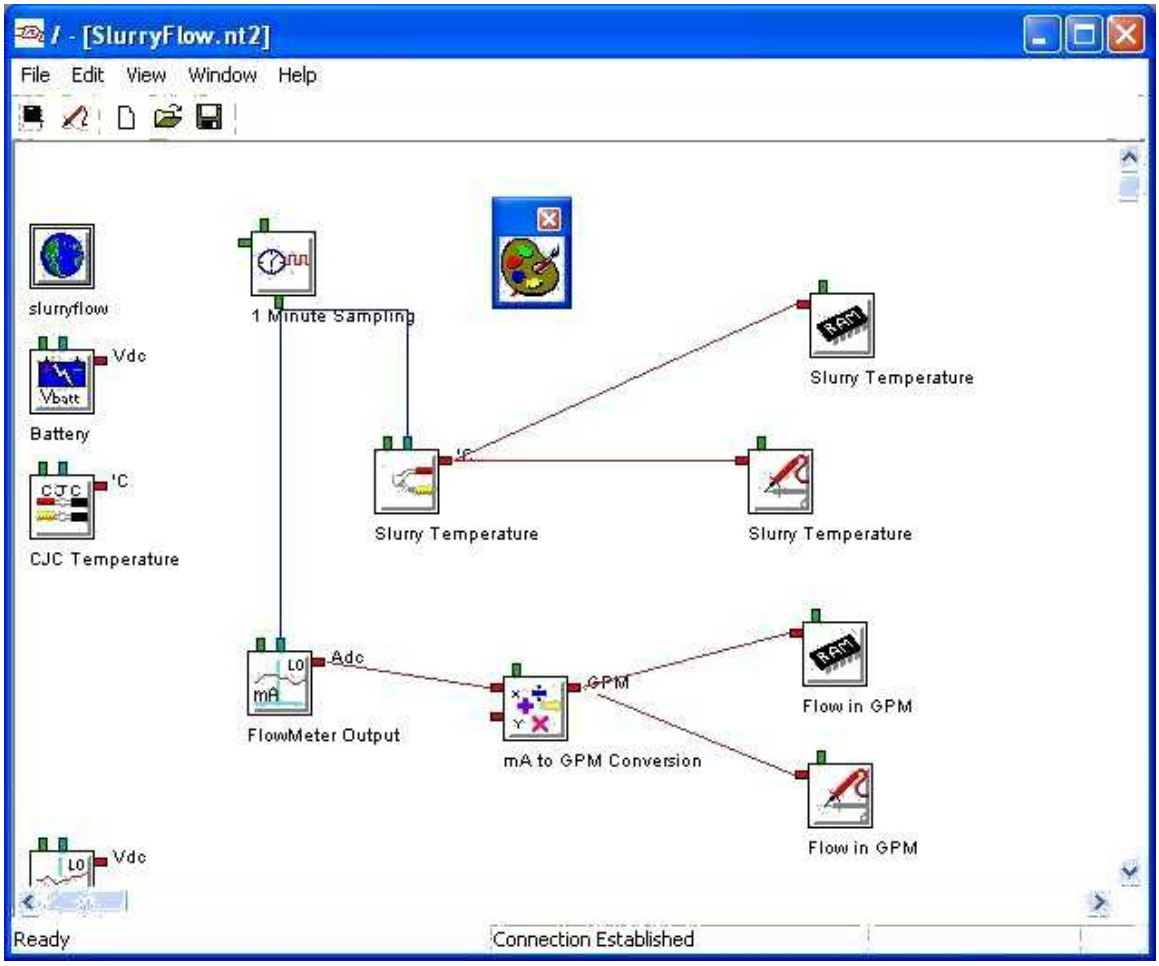


Figure 5-2; Programming Window with a Simple Program Net

REAL-TIME TRENDING WINDOW

As an IntelliLogger is executing its Program Net autonomously, a connection from a PC running HyperWare-II can be established and the current values (inputs, outputs, calculated values, etc) can be viewed. Custom Real-Time Trending screens can be designed using graphic objects from a provided palette. Objects include thermometers, analog gauges, On/Off indicators, graphic plotters, text, images and more.

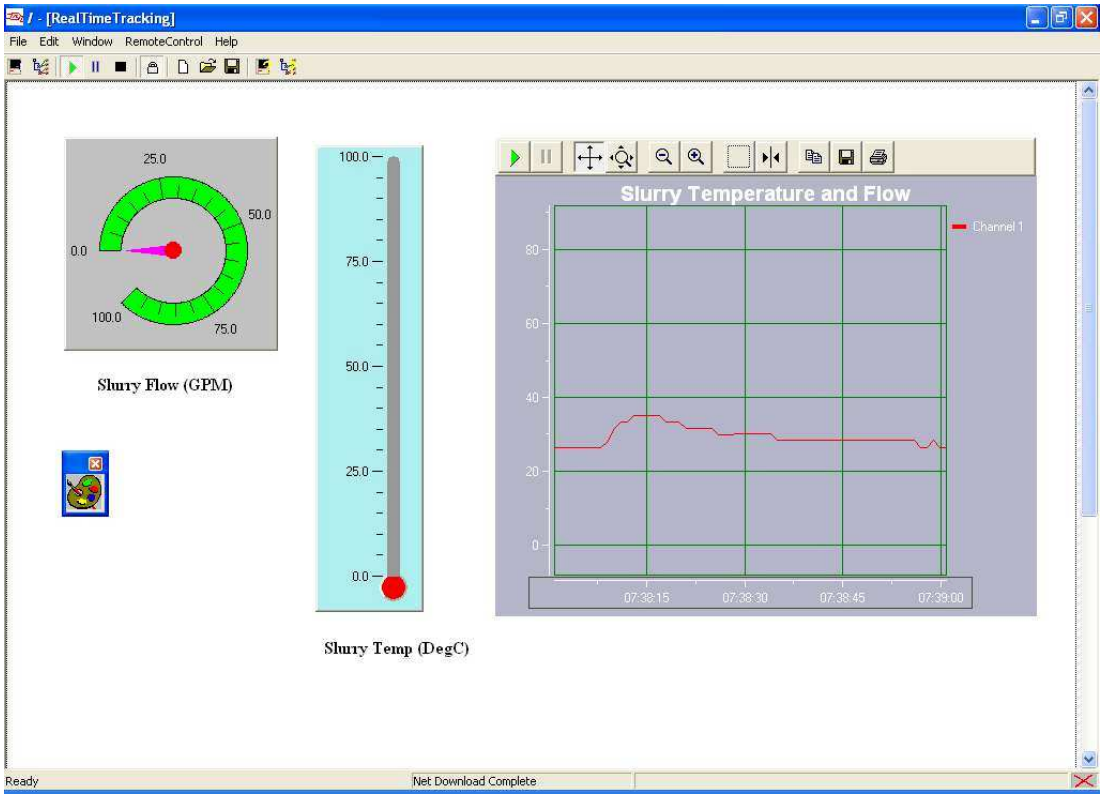
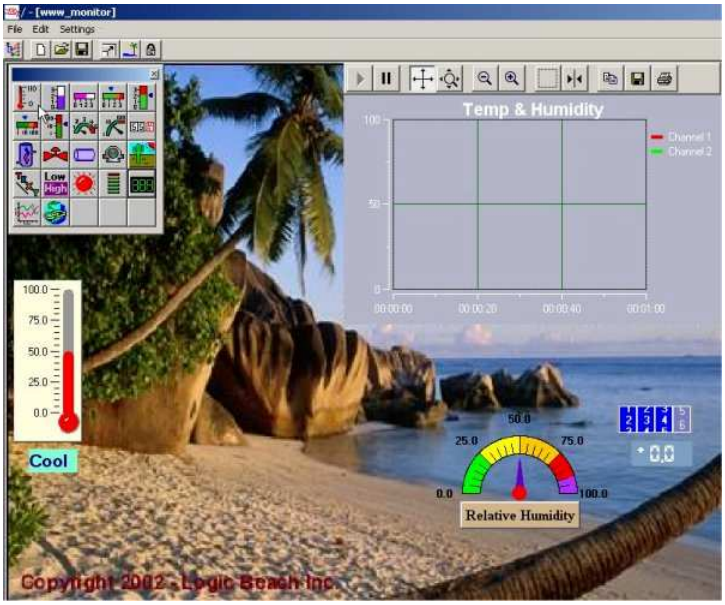


Figure 5-3; A Simple Real-Time Trending Window

CUSTOM WEB PAGE DESIGNER

From within the Programming Window, the Custom Web Page Designer window can be opened. In this window, custom web pages can be designed using drag and drop of graphic objects similar to those offered in the Real-Time Trending window. When the Program Net is uploaded to the IntelliLogger memory, these custom Web pages are also uploaded allowing for viewing of IntelliLogger sampled and calculated values via the Logic Beach GreenWater browser.

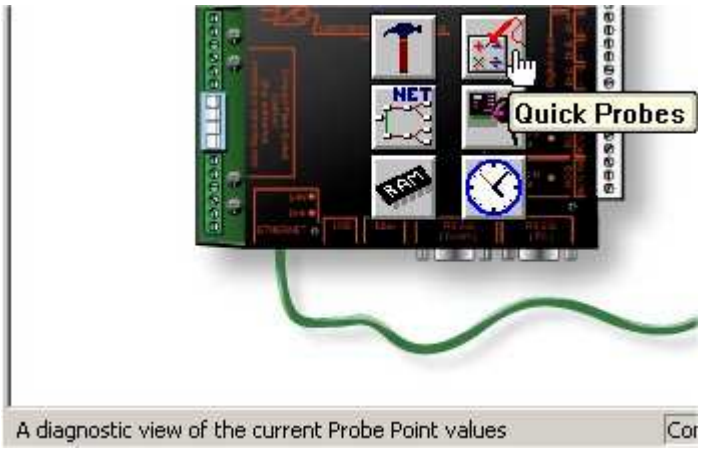


NAVIGATING BETWEEN WINDOWS

Buttons in the upper left corner of the button bar or the *Window* menu are used to switch between the Communication, Programming and Real-Time Trending windows.

HELPFUL HINTS

There are two types of information automatically displayed as the cursor hovers over icons on the Communication Window or toolbars: ToolTips and Status Bar. For example, if the cursor floats over the Probe icon on the Logger image on the Communication Window, the ToolTip only says "Quick Probes" but the status bar explains, "A diagnostic view of the current Probe Point values."



TOOLTIPS

This is a brief hint about the icon under the cursor, which shows up next to it.

STATUS BAR

When *View - Status Bar* on the menubar of the Net Programming Window is checked, a status bar with helpful information appears along the bottom of all Hyperware-II Windows.

> **Note:** If *View - Status Bar* is not checked on the Net Programming Window, the status bar and its information remain hidden away from **ALL** windows.

6 COMMUNICATION

OVERVIEW

Upon launch of HyperWare-II, the Communication window will be displayed (Figure 6-1). From within this window, communications between the PC and the Logger are initiated and handled. The graphic for the connection between the Logger and the PC depends on the last communications used.

This chapter describes the steps necessary to connect and configure the various communication connections supported between the Logger and a PC running HyperWare-II.

In the following chapter, the techniques and commands to perform various communications with the Logger is explained. These communications include commands such as Data Download, Program Upload, Status Queries, etc.

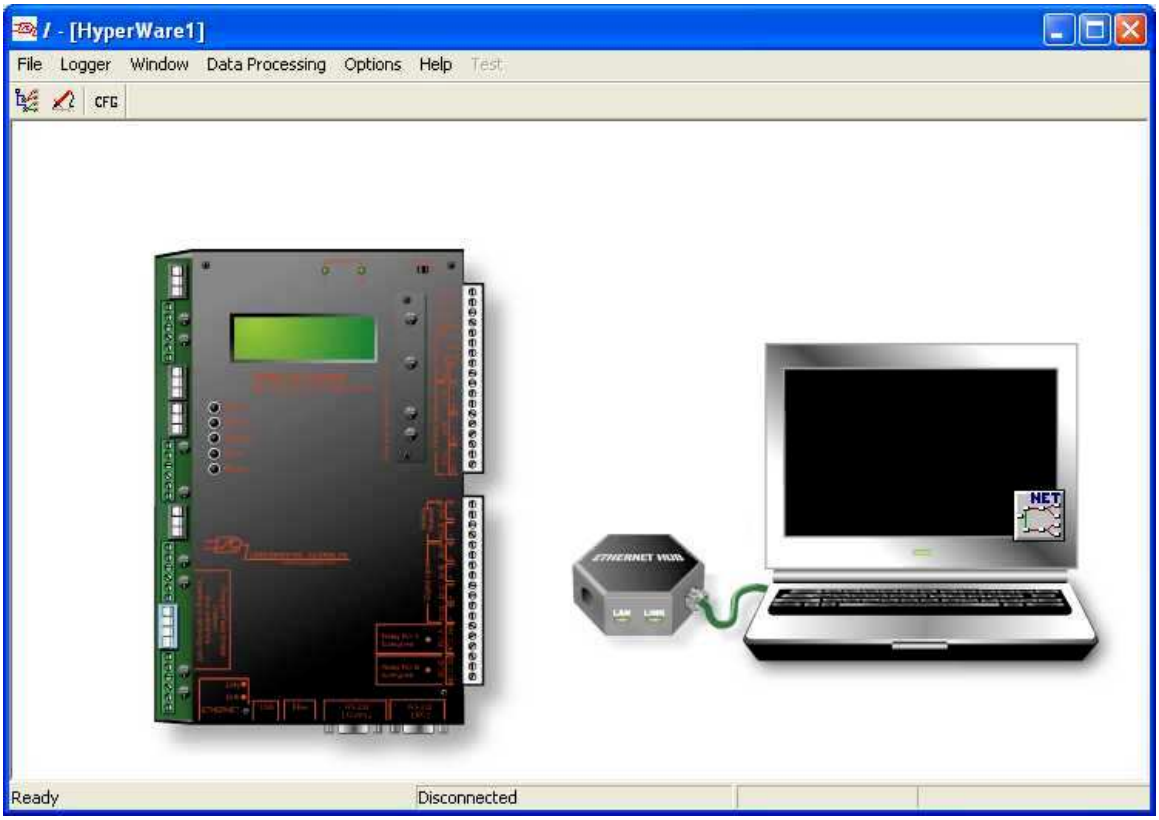


Figure 6-1; Communication Window

ESTABLISHING A USB CONNECTION

Communication between a PC and the Logger can be performed via a USB connection. In order to utilize USB communications, a USB driver must first be installed. The installation is fairly conventional and is initiated when the Logger is connected to a PC USB port and powered up.

CABLE CONNECTION

Plug the provided USB cable into the Logger USB port located at the bottom end of the unit. The other end should be plugged into a USB connector or expansion hub on the PC. The Logger utilizes USB 1.0 hence it will operate with both USB 1.0 and USB 2.0 ports.

Turn the Logger power ON and the PC should automatically detect the presence of a new USB device and display a message indicating that a new USB device has been detected.

> Note: If the *Found New Hardware Wizard* does NOT come up automatically, see *Error Recovery* below.

DRIVER INSTALLATION

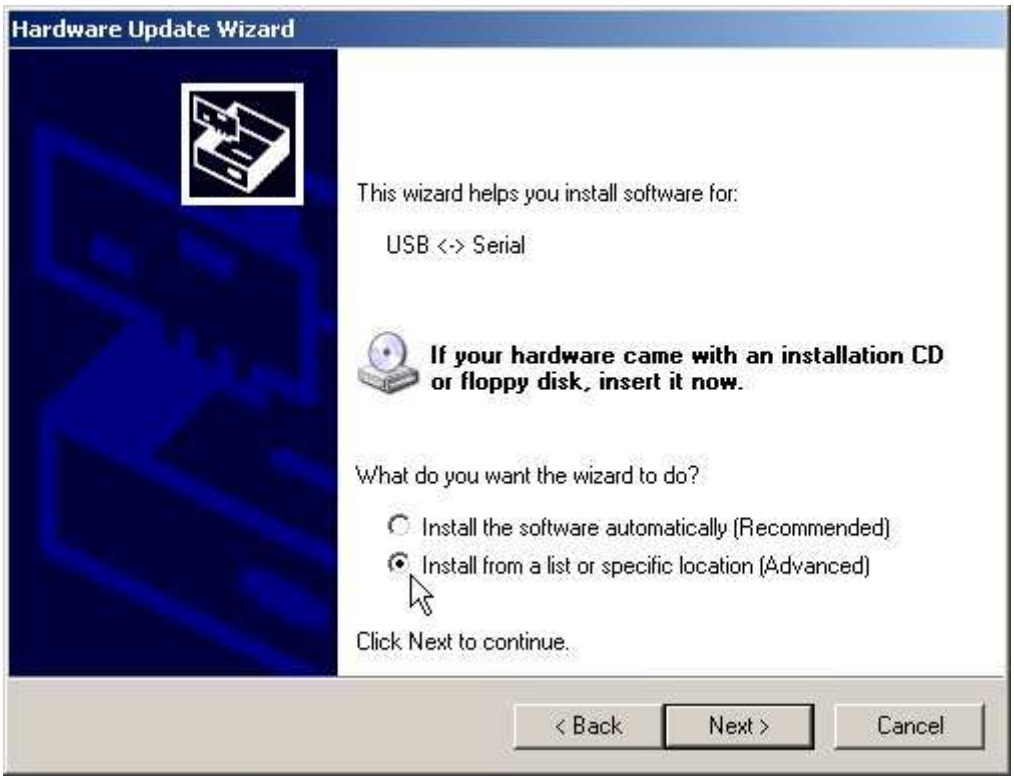
After a short delay, the *Found New Hardware Wizard* dialog will open (Figure 6-2) From the *Found New Hardware Wizard* dialog follow these steps to install the USB driver:

1. Select *No, not this time* and then click *Next*.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

Figure 6-2; Found New Hardware Wizard

2. Although the wizard indicates a CD is needed, if HyperWare-II has already been installed you should **not** need to insert an installation CD.


Hardware Update Wizard
This wizard helps you install software for:
USB <-> Serial
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

3. Select *Install from a list or specific location* and click *Next*

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
BI Apps\Hyperware II\USB Device Driver\WINXP2K
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

4. Select *Include this location in the search:* and browse to the appropriate driver subdirectory to match your Windows version.

5. As HyperWare-II has already been installed, the USB drivers have been copied from the installation CD to two subdirectories under the *HyperWare II\USB Device Driver* subdirectory. Beneath this directory are two driver directories… one for Windows 98 (called *WIN98*) and the other for Win 2000, XP and beyond (called WINXP2K).

6. Once the path is specified, click *Next*. The driver will be selected and examined.

7. Microsoft has not yet certified this USB driver, so a warning dialog will be displayed. Select *Continue Anyway* to proceed.

Hardware Installation
The software you are installing for this hardware:
USB Serial Port
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

8. The wizard will automatically perform a backup and then install the drivers.

Found New Hardware Wizard
Please wait while the wizard installs the software...
USB Serial Port
Setting a system restore point and backing up old files in case your system needs to be restored in the future.
< Back
Next >
Cancel

9. Upon clicking *Finish* the process may start over again. This is a normal sequence for this driver. Follow the same sequence once again and the installation will be completed after this second pass.

INSTALLATION ERROR RECOVERY

Some common driver installation problems are:

Partial installation

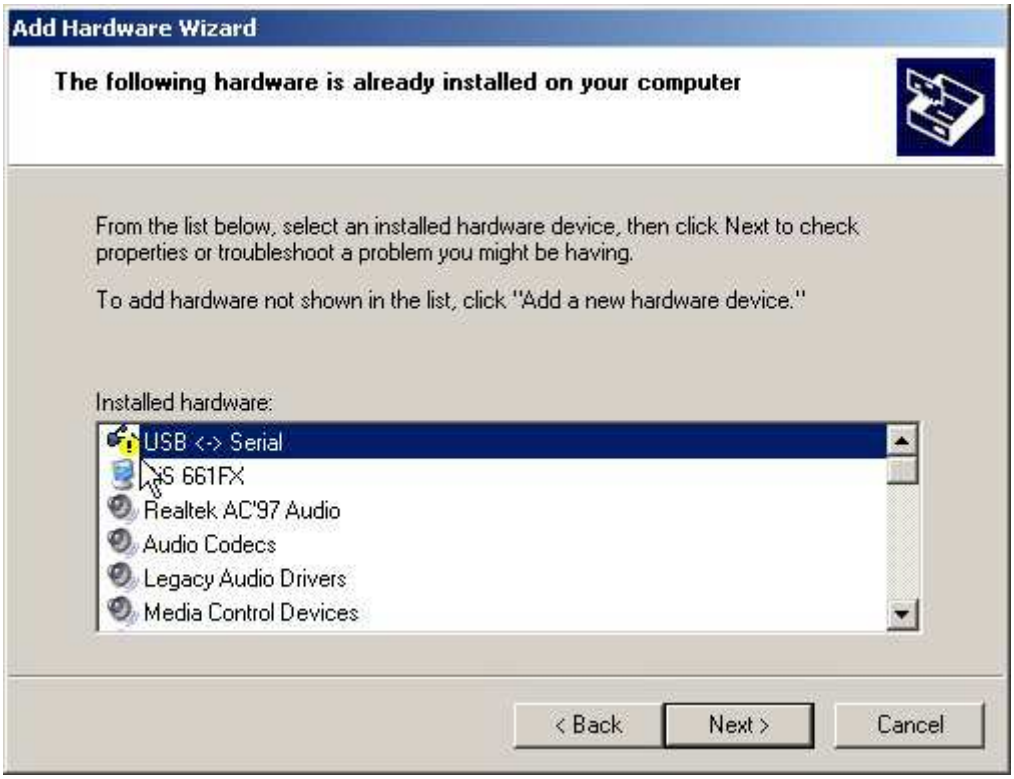
This is usually due to clicking on an inappropriate setting in one of the wizard dialogs.

Found New Hardware Wizard
Cannot Install this Hardware
There was a problem installing this hardware:
USB <-> Serial
An error occurred during the installation of the device:
The driver cannot be installed because it is either not digitally signed or not signed in the appropriate manner. Contact your hardware vendor.
Click Finish to close the wizard.
< Back
Finish
Cancel

To correct this problem, open the device manager from the following location:

Programs – Administrative Tools – Computer Management – Device Manager – Ports

Remove any partial installation (exclamation sign in yellow circle) and start the driver installation process again.

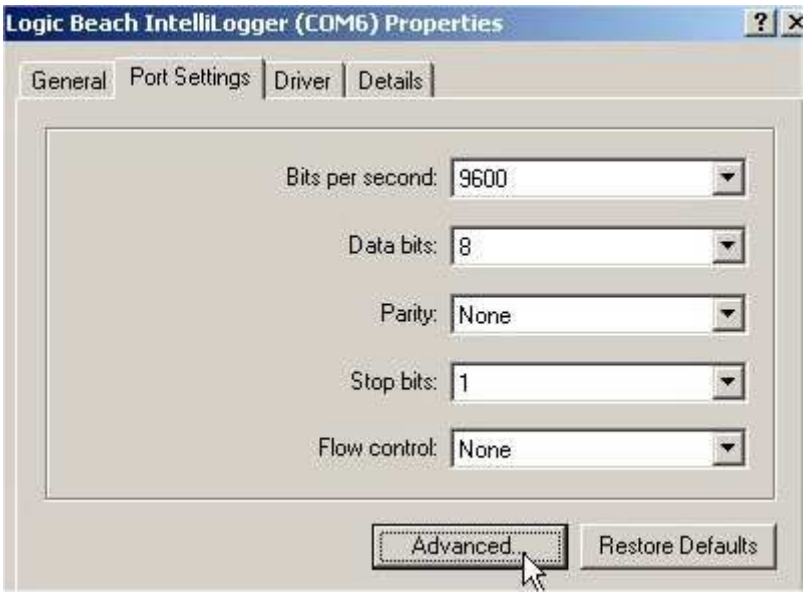

Add Hardware Wizard
The following hardware is already installed on your computer
From the list below, select an installed hardware device, then click Next to check properties or troubleshoot a problem you might be having.
To add hardware not shown in the list, click "Add a new hardware device."
Installed hardware:
USB <-> Serial
S 661FX
Realtek AC'97 Audio
Audio Codecs
Legacy Audio Drivers
Media Control Devices
< Back
Next >
Cancel

Wrong Virtual Port

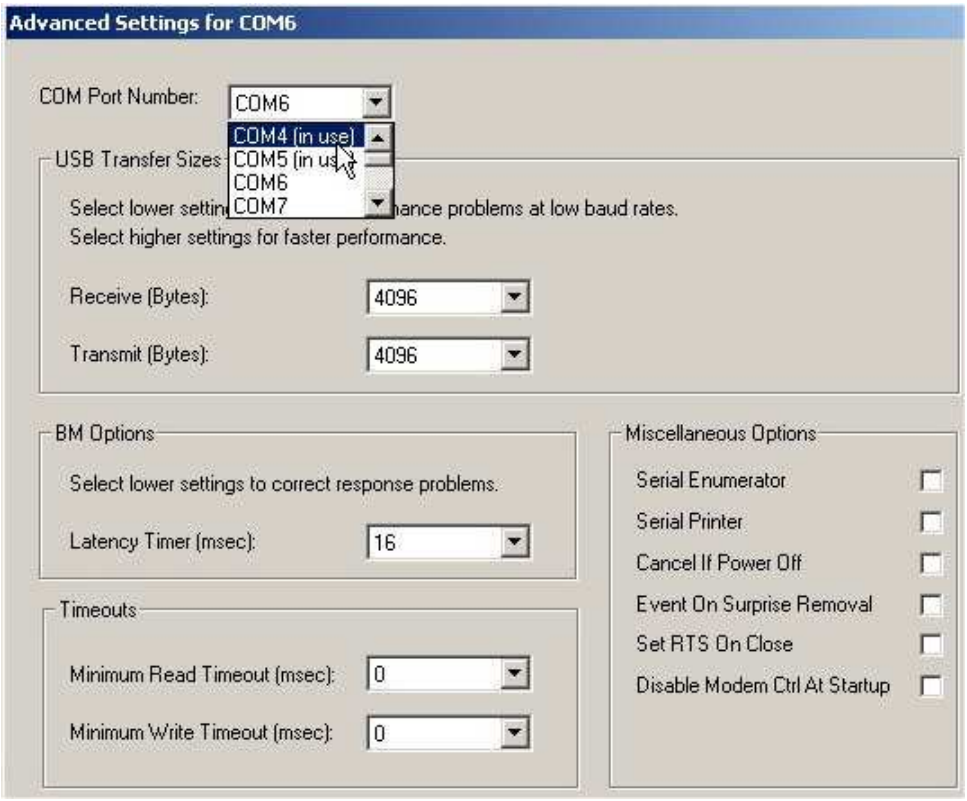
If the USB driver is fully installed on and selects a serial port that conflicts with other hardware on the PC, it may still not connect to the logger. To correct this problem, open the device manager from the following location:

Programs – Administrative Tools – Computer Management – Device Manager – Ports

Double click on the Logger entry to open the Properties dialog for that COM port



Click on the *Advance*d button to display to the settings dialog, which can be used to change the port number. Select a COM Port Number that does not conflict with other hardware on the PC.

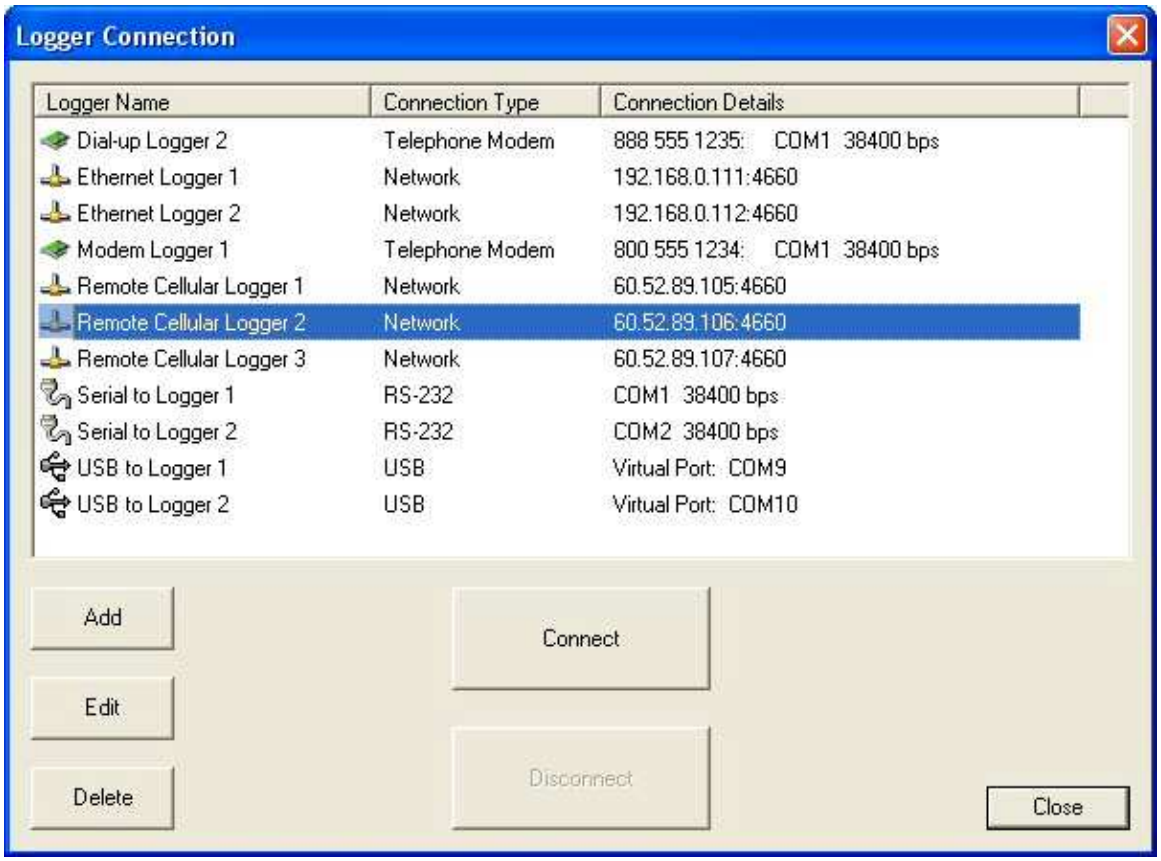


ADDING A USB CONNECTION TO THE CONNECTION DIALOG

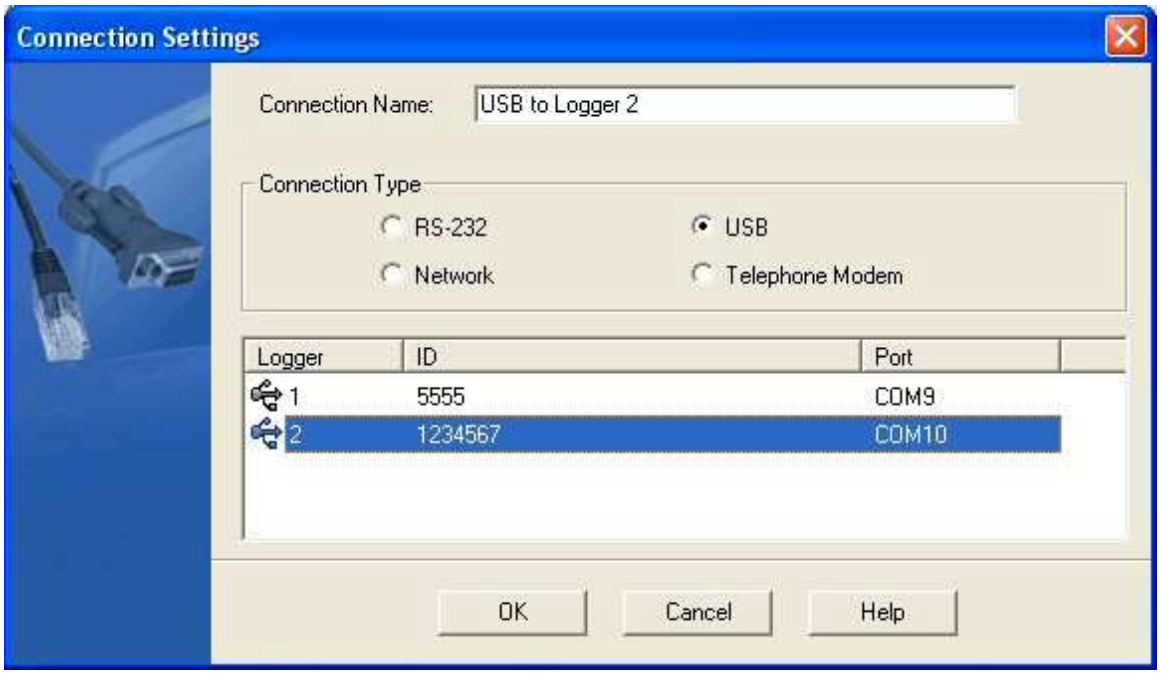
Once the USB drivers have been successfully installed (as described above) follow these steps to establish a USB connection to a Logger from a PC running HyperWare-II…

1. Launch HyperWare-II
2. From the Communications window (Figure 6-1) double-click on the graphic communication device showing at the end of the cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, a USB connector or a modem.

A *Logger Connection* dialog will open displaying a list of available connections.



3. Click on the *Add* button to begin defining a new connection. This will display the *Connection Settings* dialog.
4. Select *USB* from the Connection Type radio button options



5. Enter a name in the *Connection Name* field that you want to display in the available list of connections. This can be a familiar name that helps you remember the specific connection.
6. If there is more than one Logger shown in the list of currently connected Loggers, select the one you wish to associate with this connection.
7. Click on OK to confirm and save the settings. This newly created connection will then be added to the displayed Logger Connection dialog list, showing the connection name you entered.

CONNECTING

From the Logger Connection list, a connection can be established by selecting it with the mouse and clicking on the *Connect* button. After a short delay, the dialog will close and a full USB cable connection will display between the graphic PC and the Logger in the HyperWare-II Communications window.

DISCONNECTING

To disconnect a USB connection, simply double-click on the graphic USB connector which will open the *Logger Connection* dialog, then click on the *Disconnect* button.

ESTABLISHING AN RS-232 CONNECTION

For PC's equipped with RS-232 ports, a PC to Logger serial connection can be established.

CABLE CONNECTION

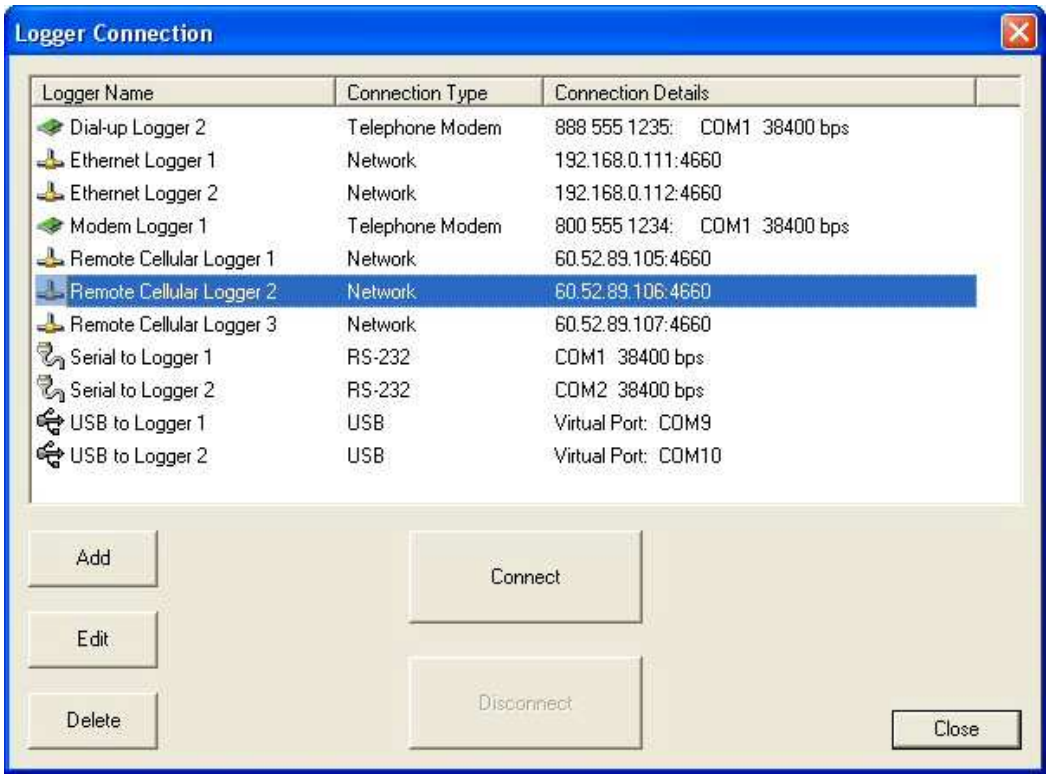
The Logger has a 9-pin DB-9/F (female) connector located at the bottom end. Utilize a standard RS-232 cable to connect from the Logger RS-232 port which is labeled *RS-232 [PC]* to a standard RS-232 Com port on the PC.

ADDING AN RS-232 CONNECTION VIA THE LOGGER CONNECTION DIALOG

To establish an RS-232 connection to an Logger from a PC running HyperWare-II…

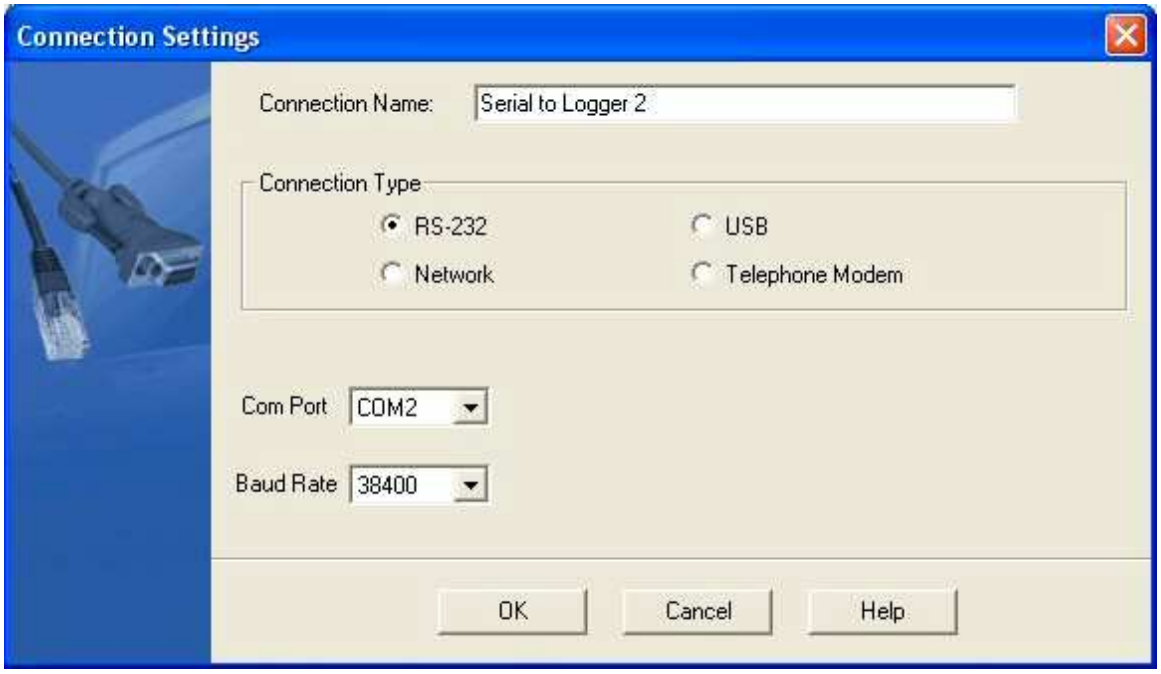
1. Launch HyperWare-II
2. From the Communications window (Figure 6-1) double-click on the graphic communication device shown at the end of the cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, a USB connector or a modem.

A *Logger Connection* dialog will open displaying a list of available connections.



3. Click on the *Add* button to begin defining a new connection. This will display the *Connection Settings* dialog.

4. Enter a name in the *Connection Name* field that you want to display in the available list of connections. This can be a familiar name that helps you remember the specific connection.
5. Select *RS-232* from the Connection Type radio button options



6. Specify the Com Port on the PC to which the serial cable is connected and the Baud rate to use. For most applications, 115.2K will provide fast reliable operation. Use a slower rate if long cables or communication errors display.
7. Click on OK to confirm and save the settings. This newly created connection will then be added to the displayed Logger Connection dialog list, showing the connection name you entered.

CONNECTING

From the Logger Connection list, a connection can be established by selecting it with the mouse and clicking on the *Connect* button. After a short delay, the dialog will close and a complete serial cable connection will display between the graphic PC and the Logger in the HyperWare-II Communications window.

DISCONNECTING

To disconnect a serial connection, simply double-click on the graphic DB-9 connector which will open the *Logger Connection* dialog, then click on the *Disconnect* button.

ESTABLISHING A PSTN TELEPHONE MODEM CONNECTION

Conventional PSTN[3] connections can be used for communication between a PC equipped with a modem and a field Logger equipped with a Logic Beach MDM-10 modem.

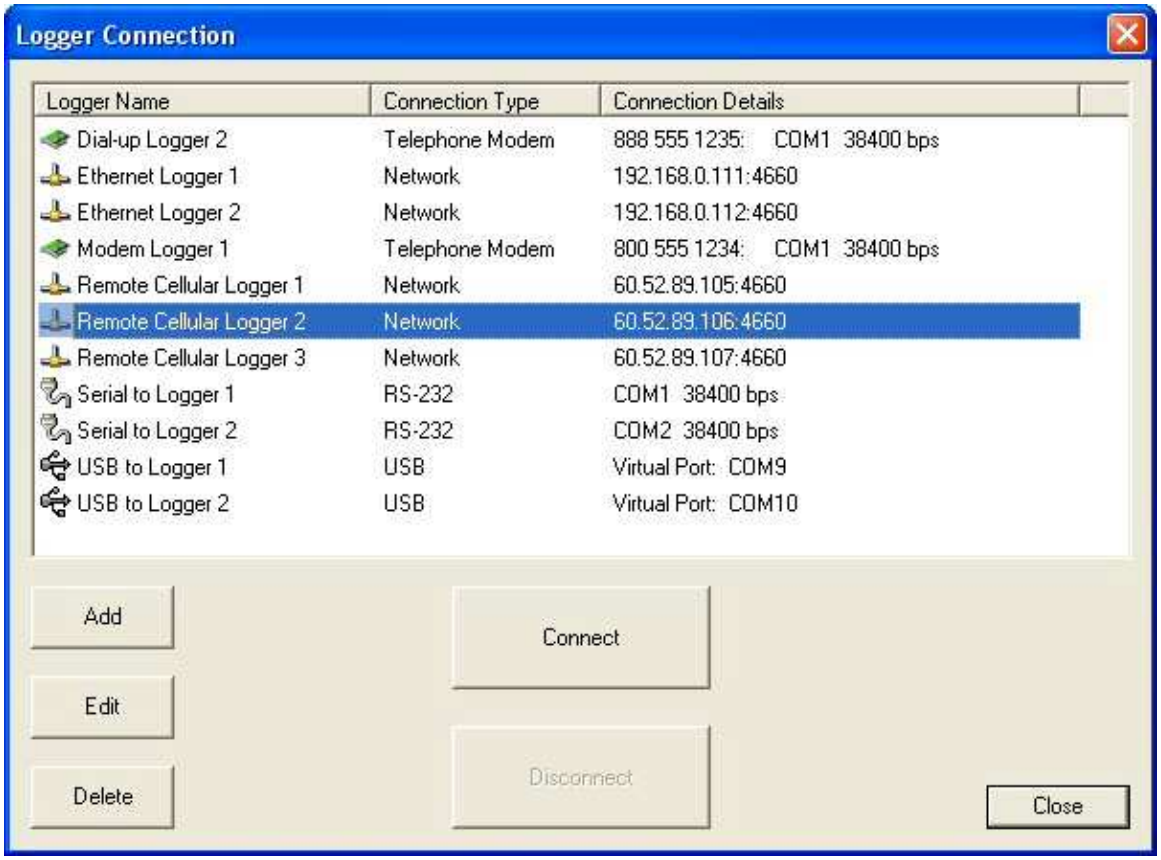
MODEM CONNECTION

Insure that a modem with driver has been installed internal to the PC or via an external RS-232 (or USB port).

To establish a modem to an Logger from a PC running HyperWare-II…

1. Launch HyperWare-II
2. From the Communications window (Figure 6-1) double-click on the graphic communication device showing at the end of the cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, a USB connector or a modem.

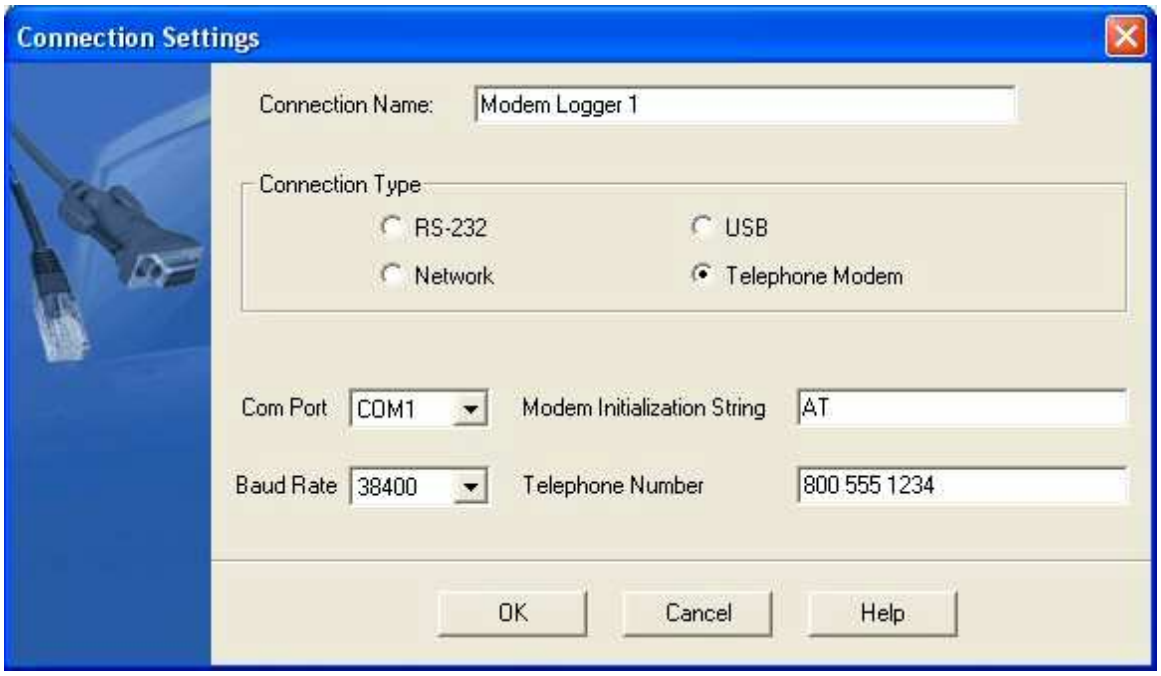
A *Logger Connection* dialog will open displaying a list of available connections.



3. Click on the *Add* button to begin defining a new connection. This will display the *Connection Settings* dialog.

[3] Public Switched Telephone Network - the conventional hard-wired phone system network

4. Enter a name in the *Connection Name* field that you want to display in the available list of connections. This can be a familiar name that helps you remember the specific connection.
5. Select *Telephone Modem* from the *Connection Type* radio button options.



6. Specify the Com Port on the PC to which the modem is connected and the Baud rate to use for communication between the PC and the PC modem. For most applications, 115.2K will provide fast reliable operation.
7. For some modem types, it may be necessary to specify a *Modem Initialization String*. This is only for dialing from the PC with HyperWare-II to the Logger. A good modem initialization string to use in most cases is "AT&F1E0Q0V1X4&D0" (where "0" is the number zero and not the letter oh).

Command	Meaning
AT	Start command string
&F1	Reset to factory defaults
E0	Disable command mode echo
Q0	Send result codes
V1	Verbal result codes
X4	Enable all result codes
&D0	Ignore DTR
&K0	Disable data compression.
&M0	Disable error correction
&N6	Maximum speed is 9600 baud
&N4	Maximum speed is 4800 baud
&N3	Maximum speed is 2400 baud
&N2	Maximum speed is 1200 baud

Table 6-1; AT Initialization Commands

8. Enter the *Telephone Number* of the field Logger. Enter the full numerical sequence required for establishing contact (i.e. a '1' and Area Code if necessary). Do not use dashes or parentheses.

9. Click on OK to confirm and save the settings. This newly created connection will then be added to the displayed Logger Connection dialog list, showing the connection name you entered.

CONNECTING

From the Logger Connection list, a connection can be established by selecting it with the mouse and clicking on the *Connect* button. After a short delay, while dialing, modem to modem negotiation and connection is established, the dialog will close and a complete modem connection will display between the graphic PC and the Logger in the HyperWare-II Communications window.

DISCONNECTING

To disconnect a modem connection, simply double-click on the graphic modem connector which will open the Logger Connection dialog, then click on the Disconnect button.

ESTABLISHING AN ETHERNET CONNECTION

The Logger can be connected via Ethernet 10Base-T directly to a PC (using a cross-over cable) or added as a node on a Local Area Network (LAN). Before an Ethernet connection can be established with a Logger, various Network parameters must be configured within the instrument.

The following sequence of steps is required to setup the Logger for Ethernet connectivity:

Establish an RS-232 or USB connection with the Logger (Ethernet is not yet configured, therefore cannot be used)

Configure the Network parameters (IP address, etc) within the Logger Configuration / Network Tab.

Upload the new Logger Configuration to the Logger non-volatile memory by clicking on the *Send to Logger* button.

This will automatically reset the Logger so that it will adopt these new Logger Configuration settings.

Details for each of the above steps follow:

1. ESTABLISH A USB OR RS-232 CONNECTION

Connect to the logger using your preferred ***direct*** connection method. In order to perform the Ethernet configuration, a USB or RS-232 connection must be established (using one of the procedures described above) such that HyperWare-II can be used to set the Network Parameters.

If not already done, follow the procedures described above to establish a USB or RS-232 connection with the Logger.

2. NETWORK PARAMETER CONFIGURATION SETTINGS

The Logger is designed with a collection of Configuration Settings that are typically unique to each individual Logger. These settings include non-editable settings such as the unit Serial Number as well as user editable settings such as Unit Name, IP address, modem settings, etc. The Logger Configuration settings are written to non-volatile memory within the IL and are securely retained regardless of power status.

In order to utilize the Ethernet connection capability of the Logger, a number of Configuration Settings specific to Networking must first be setup. The following is a direct step by step

procedure to set the Logger Configuration settings pertaining to activating the Ethernet connectivity.

Stop the Logger

Before making any configuration changes to a logger, it is always advisable to ensure the logger is in a stopped state before continuing. You should do so before moving on to the next step, by either pressing the Stop button on the front of the logger, or double-clicking the stop button on the logger image.

Open the System Configuration Dialog

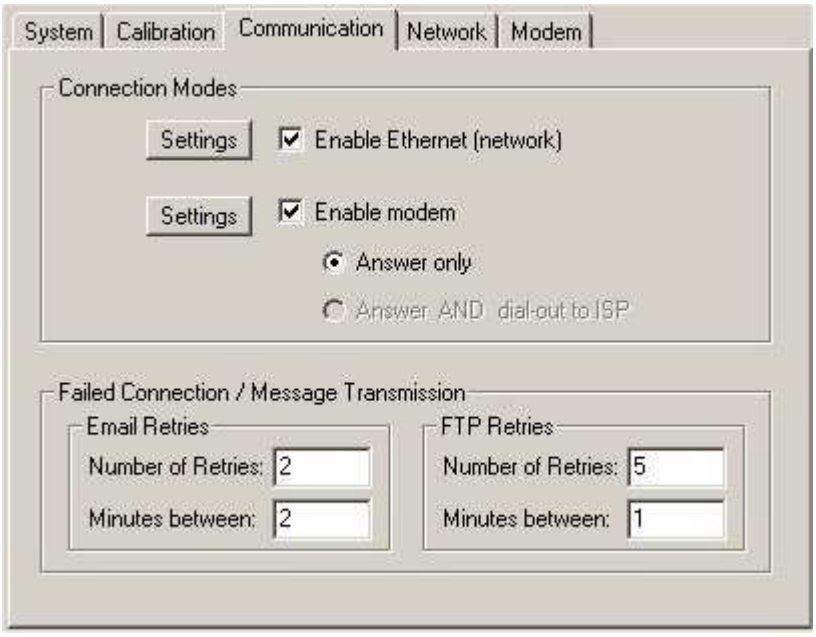
From the Communication Window, select the Logger Configuration option from the Logger menu to open the System Configuration dialog, or double click on the Tools icon above if present.

The Logger System Configuration dialog will open immediately and if a Logger is connected, the dialog will begin retrieving the current configuration settings from the Logger. After a few seconds delay, all the tabs of the dialog will be displayed.

Click on the *Communication* tab.

Enable Ethernet

If Ethernet is to be used for communications, insure that the *Enable Ethernet* checkbox is checked.

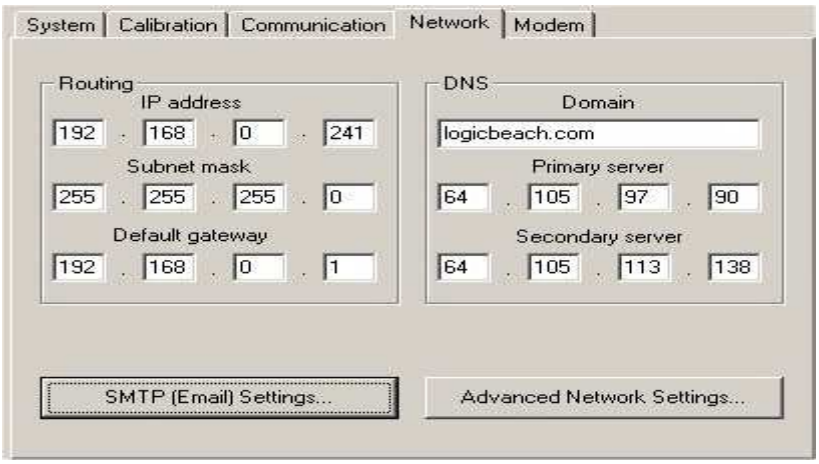


Specify Email / FTP Retry

In the event that an attempt to send an Email message or a data files via FTP is prevented for some reason, the Logger will retry at a later time. The *Number of Retries* setting defines the number of times to try to send and the *Minutes between* defines the amount of time in minutes to wait before each attempt.

Specify *Routing* Settings

Next click on the *Network* tab.



Within the *Routing* section of the dialog are the IP Address, Subnet Mask and the Gateway settings. Assign values as required by your LAN and/or per your Network Administrator's directions. If the Logger will be connected to the same LAN as your PC, the Subnet Mask and the Gateway settings may be gleaned from the Network settings for your PC. The IP address however must be unique on the LAN and must be assigned by the party tracking the IP addresses currently in use by the LAN.

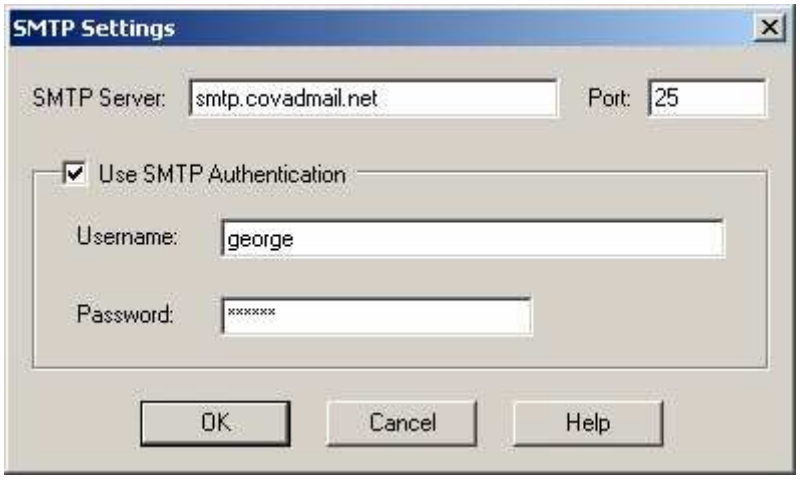
Note that the Logger uses a fixed IP address.

***Specify DNS* (Domain Name Server) Settings**

Domain Name Server (DNS) settings point the Logger to the server that provides the translation of English names (e.g. logicbeach.com) to an actual Internet address in IP format (e.g. 111.222.333.44)

Enter your Domain name and the Primary DNS and Secondary DNS IP addresses. Typically, your Internet Service Provider (ISP) or your Network Administrator will provide these. In many cases, these may also be set to the same as used by a PC on the LAN to which the Logger is being connected.

Specify SMTP (Simple Mail Transfer Protocol) Settings



These settings specify the Email server to be used by the Logger when sending Email. The settings include a Server name, typically in a format such as 'smtp.yourmailserver.net' along with a Port Number.

If the Logger is on the same LAN as a PC, the Email Server name and Port may be gleaned from the PC Email client settings.

In almost all conventional applications, the Port Number is set to '25', or rarely '110', or possibly some other number.

3. UPLOAD THE CONFIGURATION TO THE LOGGER

Click on the *Send to Logger* button at the bottom of the Logger Configuration dialog to upload the settings to the Logger. The Logger will force a reset and read the Configuration parameters from non-volatile memory, so the new settings will be in effect.

Optionally, the settings can be saved to a file on the PC hard drive (for future reference and/or for use in multiple Logger deployments) with the *Save to File* button.

CABLE CONNECTION

A CAT5, CAT5e or CAT6 cable should be used for connecting the Logger to a PC or LAN.

Connecting to a PC

Use a 'cross-over' type cable for the physical direct connection of a Logger to a PC equipped with a Network port.

Connecting to a LAN

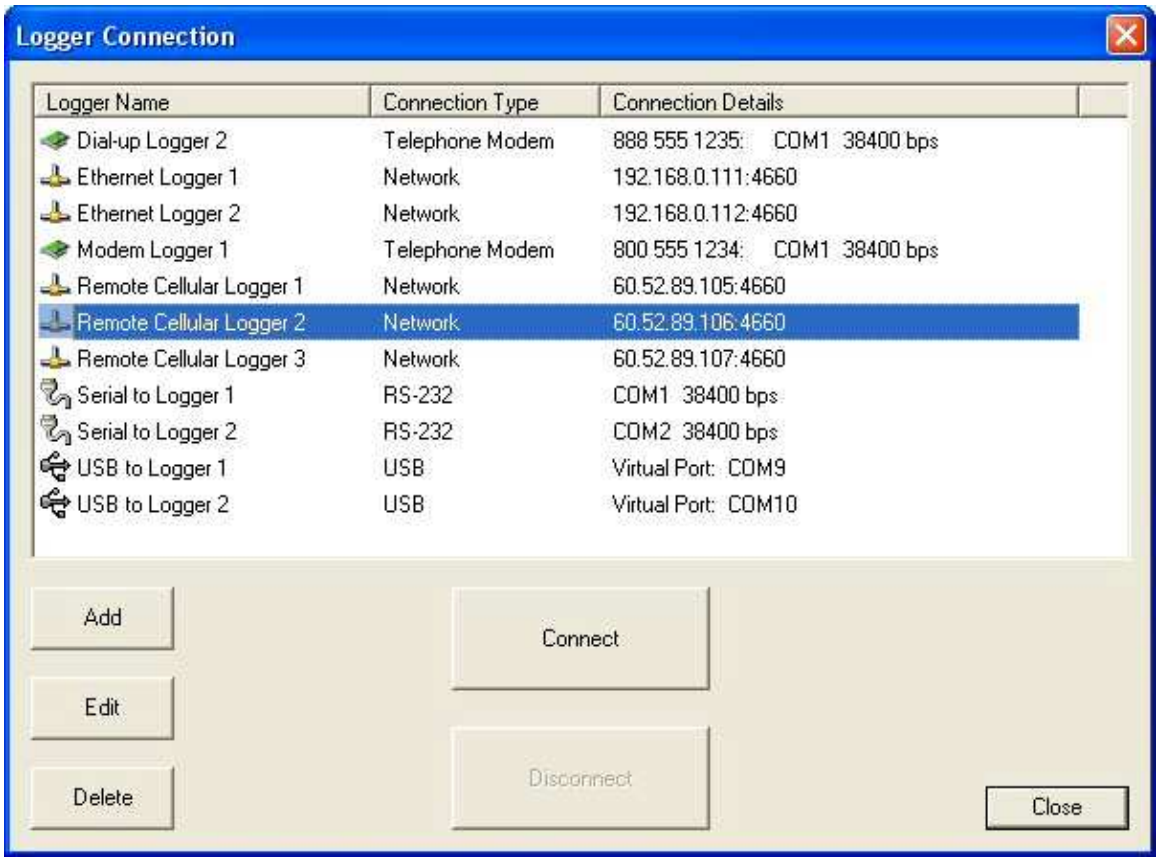
Use a standard cable for physical connection between a Logger and a LAN hub, router or bridge.

ADDING A NETWORK CONNECTION VIA THE LOGGER CONNECTION DIALOG

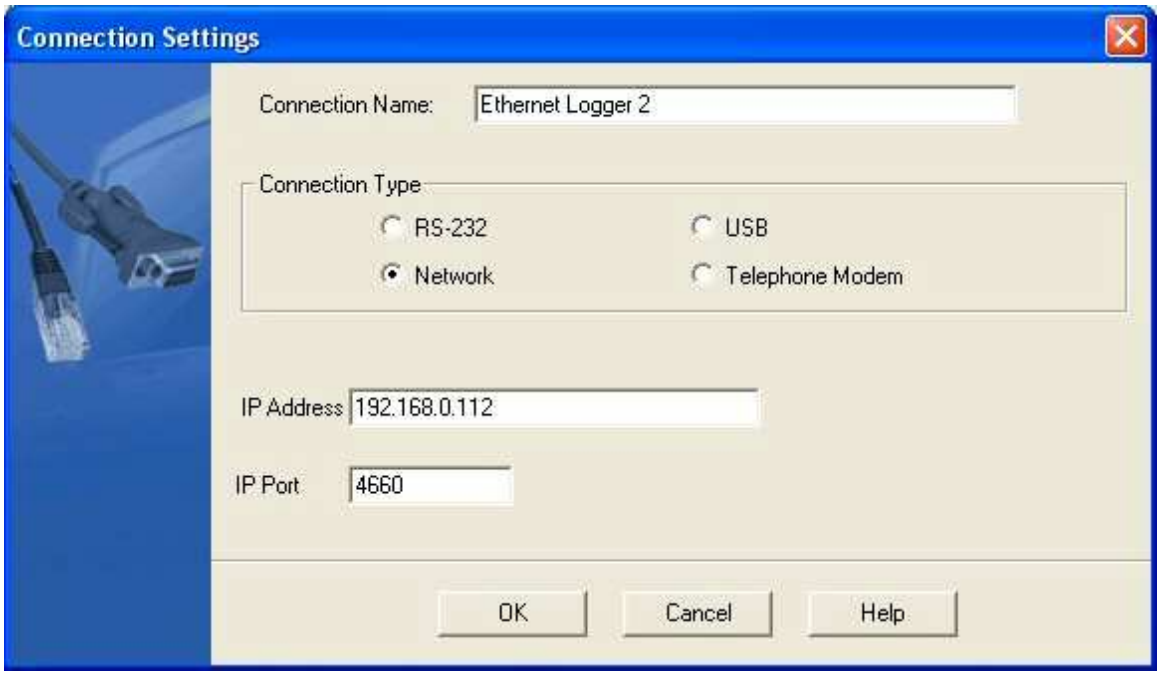
To establish a network connection to an Logger from a PC running HyperWare-II…

1. Launch HyperWare-II
2. From the Communications window (Figure 6-1) double-click on the graphic communication device showing at the end of the cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, or a modem.

A *Logger Connection* dialog will open displaying a list of available connections.



3. Click on the *Add* button to begin defining a new connection. This will display the *Connection Settings* dialog.
4. Enter a name in the *Connection Name* field that you want to display in the available list of connections. This can be a familiar name that helps you remember the specific connection.
5. Select *Network* from the Connection Type radio button option



6. Enter the IP Address (e.g. 192.168.0.122) and the *IP Port* [4](default for most Logger communications is 4660) of the Logger to which you want to connect.
7. Click the OK button to confirm and save the settings. This newly created connection will then be added to the displayed Logger Connection dialog list, showing the connection name you entered.

CONNECTING

From the Logger Connection list, a connection can be established by selecting it with the mouse and clicking on the *Connect* button. After a short delay (and assuming the unit is on the LAN at the address specified) the dialog will close and a complete Ethernet cable connection will display between the graphic PC and the Logger in the HyperWare-II Communications window.

DISCONNECTING

To disconnect an Ethernet connection, simply double-click on the graphic Ethernet hub connector which will open the Logger Connection dialog, then click on the Disconnect button.

[4] The Port number used by the Logger has a default value of 4660. One situation where the port may need to be changed would be if a firewall (or an ISP) was blocking communications for this particular port. Selecting an appropriate port number to use is often the job of a Network Administrator, however this is typically an unblocked (or open) port on the firewall that allows communication through. Generally port numbers below 1000 are already assigned to well known system services. You may be able to utilize one of these well known ports that is not being used (that are well documented on the Internet), such as SSH port 22, or select an unused higher port number (no greater than 65535). Both the Logger and HyperWare must be configured to use this same port for communication once selected. A similar option exists to change the HTTP Port assignment on the Logger from its default value of 80.

Another case where a different Port number might be used is if multiple Loggers are installed on the LAN side of a router that has Network Address Translation (NAT) capability. The router has a single IP address to the outside world however traffic received at this single IP address can have different Port numbers attached. Upon receipt by the router, the IP address and Port number will be translated as they pass through the router (using a Network Administrator implemented NAT table in the router) to IP addresses that are unique in the LAN and all have the same Port number of 4660. In order for this work, the Loggers on the LAN side are then configured to different IP addresses but all using the Port number of 4660.

ESTABLISHING A WIRELESS ETHERNET CONNECTION

The Logger can be equipped with a cellular Packet-Switched modem that allows for connectivity between a PC and the logger via the Internet. Before a cellular Packet-Switched modem connection can be established, the Logger must be configured for an Ethernet connection, as described in the previous section.

The following sequence of steps is required to configure a Logger for Ethernet connectivity with a cellular modem:

1. Establish an Ethernet connection
2. Change the Network parameters
3. Upload the new Logger Configuration and automatically Reset

Details for each of these steps follow:

ESTABLISH AN ETHERNET CONNECTION

For greater, please detail refer to *Establishing an Ethernet Connection* in the previous section.

Connect to the Logger

Do this using your preferred **direct** connection method, either USB or RS-232.

Stop the Logger

Before making any configuration changes to a logger, it is always advisable to ensure the logger is in a stopped state before continuing. You should do so before moving on to the next step, by either pressing the Stop button on the front of the logger, or double-clicking the stop button on the logger image.

Open the System Configuration Dialog

Double click the icon on the Logger image of the Communication Window.

CHANGE THE NETWORK PARAMETERS

Only the Communications Tab and the Network Tab need to be changed or checked.

Communications

Within the System Configuration Dialog, on the Communications Tab, make certain that the *Enable modem* checkbox is **NOT** checked. Although it has the word “modem” in its name, the cellular modem behaves more like a network router than a dial-up modem. You don’t need to worry about the details of this, however this is an important distinction.

> **Note:** The cellular modem connection is configured as Ethernet, **not** a dial-up modem

Network

On the Network Tab, several parameters should be changed for cell modem use.

IP ADDRESS / DEFAULT GATEWAY

In general, all IP addresses that start with 192.168.x.x are non-routable addresses. This means that routers should not attempt to route these IP addresses to another network. The third number for each of these IP addresses is the subnet. For the

MultiTech™ cellular modem, this is generally set to 2, for Airlink Modems, the number is 13 by default with the fourth number being 31.

To clarify:

MultiTech Cellular Modems: use 192.168.2.1 as the default gateway.

Airlink Cellular modems use 192.168.13.31 as the default gateway.

Cellular modems, using non-zero subnets, is actually quite a good idea, because it separates the modems from many local area networks, which typically use the default subnet of zero.

The Net Mask can normally remain the same (255.255.255.0).

DOMAIN

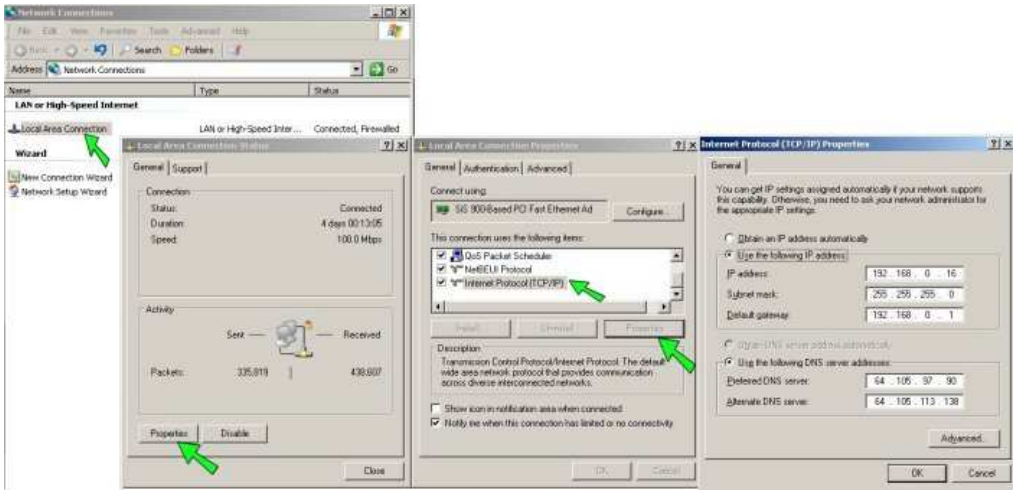
Users are encouraged to put their own domain name in above the two DNS entries. Remember that this is entirely different from the DNS entries despite the fact that they appear in the same group box.

PRIMARY/ SECONDARY SERVER

The primary and secondary DNS servers shown are generic ones on the Internet. Users should be encouraged to enter DNS server entries of their own choosing here, which may be physically closer to them (therefore quicker). Any DNS servers will actually work, they will just operate with different delays due to their physical location on the Internet with respect to whatever is trying to use them.

To select a DNS server, check the network settings of a PC already connected to the network for the most appropriate DNS servers to use. The following is an example using Windows XP™

Under LAN Properties, select TCP/IP and click the Properties button to view these settings.



Upload the new Logger Configuration and automatically Reset

Upload these settings to the Logger's non-volatile memory by clicking on the Send to Logger button. This will automatically reset the Logger, which will adopt these new Configuration settings.

CONNECTING THE MULTITECH™ CELLULAR MODEM

Antenna

Connect the antenna to the rear SMA connection (labeled GSM/CDMA), and then connect the power source to the modem. If using the stub antenna, this should generally be pointed upward in a vertical direction for best reception.

The PWR LED on the front panel should illuminate as soon as power is applied, then after a minute or two, the TR and CD LED's should come on together (and stay on) indicating a connection to the cellular network has been established.

Connect to Logger

Connect the modem to the logger using the special "crossover" Ethernet cable supplied.

Note that this crossover cable is not the same as a normal Ethernet cable connecting computers to a wall socket, or a hub, the wiring is slightly different – these crossover cables are generally colored yellow (and often marked too) to highlight this difference.

Connect one end of the crossover cable to the 10/100 port on the rear of the modem, and the other end of the cable to the Ethernet port of the Logger.

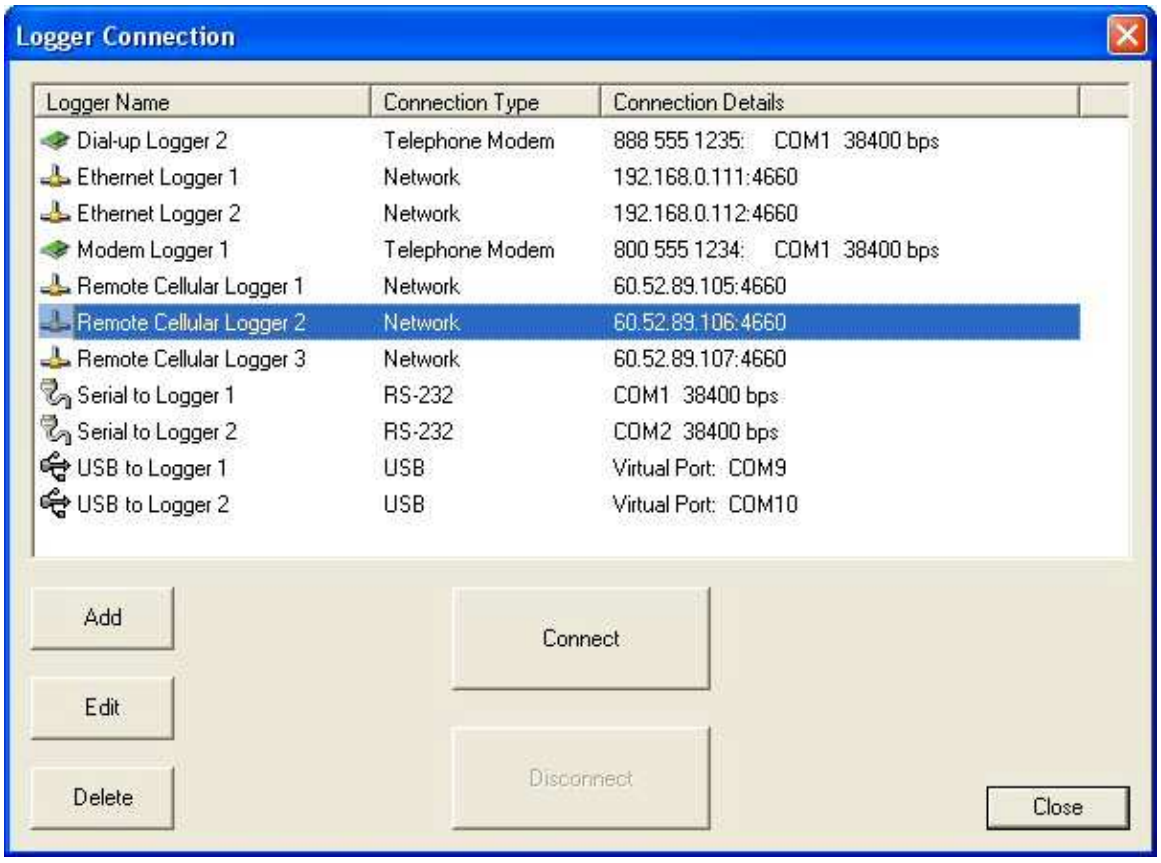
Once connected to the Logger, the L/A LED should illuminate or flash to indicate connectivity between the logger and the modem.

ADDING A NETWORK CONNECTION VIA THE LOGGER CONNECTION DIALOG

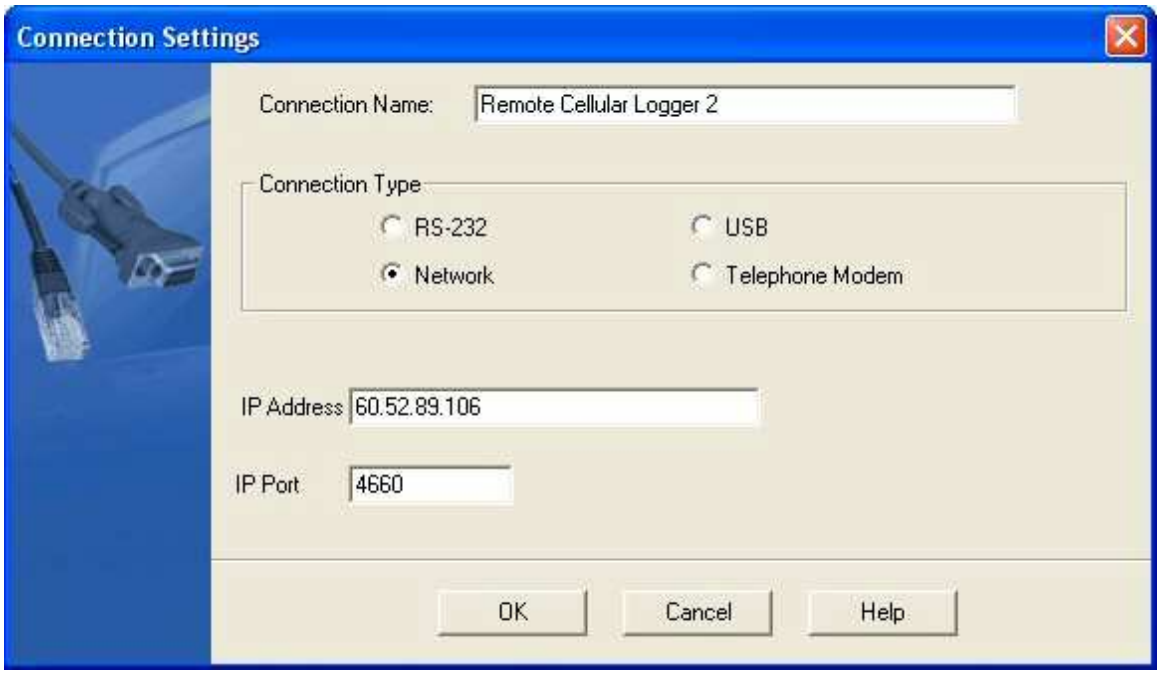
To establish a network connection to an Logger from a PC running HyperWare-II…

1. Launch HyperWare-II
2. From the Communications window (Figure 6-1) double-click on the graphic communication device showing at the end of the cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, or a modem.

A *Logger Connection* dialog will open displaying a list of available connections.



3. Click on the *Add* button to begin defining a new connection. This will display the *Connection Settings* dialog.
4. Enter a name in the *Connection Name* field that you want to display in the available list of connections. This can be a familiar name that helps you remember the specific connection.
5. Select *Network* for the Connection Type radio button option.



6. For *IP address*, enter the Dynamic DNS URL (universal resource locator) of the Logger to which you want to connect.

Dynamic DNS

Since the modem is part of the digital cellular network, it is configured to be part of the Internet. The digital cellular network is dynamic, with IP addresses changing continually. A special feature, called Dynamic DNS, provides a consistent method of addressing the modem despite the changing IP address. Whenever its URL is used, the Internet will return an actual IP address in its place.

URL

The URL may be preset at the factory, or may depend upon the Service Provider you have chosen. Check your paperwork. Some example Cellular Modem URLs are:

demo01.dyndns.org	(MultiTech™ modem)
1234ABCD.eairlink.com	(AirLink™ modem)
6195551234.internet.cingular.com	(Cingular provider)

7. The *IP Port* for most Logger communications is 4660.
8. Click the OK button to confirm and save the settings. This newly created connection will then be added to the displayed Logger Connection dialog list, showing the connection name you entered.

CONNECTING

From the Logger Connection list, a connection can be established by selecting it with the mouse and clicking on the *Connect* button. After a short the dialog will close and a complete Ethernet hub cable connection will display between the graphic PC and the Logger in the HyperWare-II Communications window

DISCONNECTING

To disconnect a cellular modem connection, simply double-click on the graphic Ethernet hub connector which will open the Logger Connection dialog, then click on the Disconnect button.

7 COMMUNICATION WINDOW

OVERVIEW

From the Communications Window within HyperWare-II, many operations may be performed including Uploading of information to the Logger (Program Nets, Date/Time, custom Web pages, etc) Downloading information from the Logger to the PC (logged data, status, Probe Point values) as well sending operational commands to the Logger such as Enable, Stop and Clear Memory.

WINDOW LAYOUT

The Communication Window displays whenever HyperWare-II is launched. Throughout HyperWare, most information is displayed graphically with the intent of quickening the learning curve.

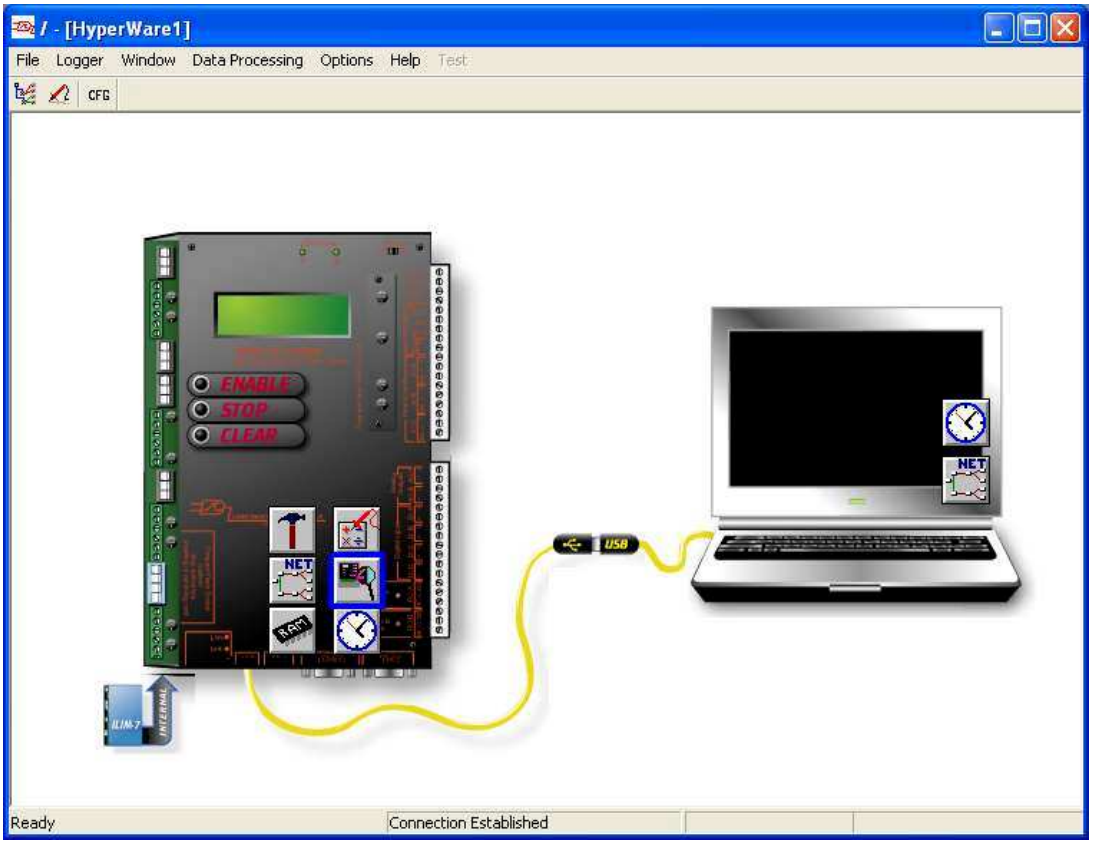


Figure 7-1; Communications Window with USB connection established

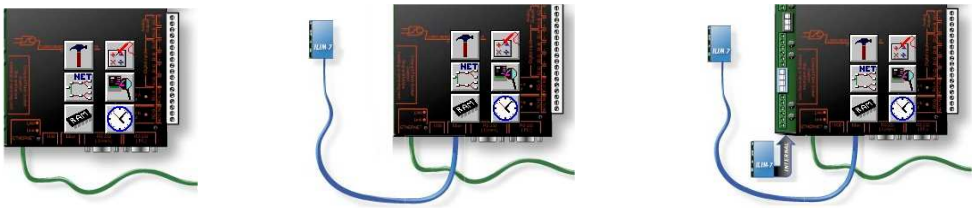
CONNECTION STATUS

When a communication link is established between a PC running HyperWare-II and a Logger, a complete link cable is displayed with a connector or other device (e.g. Ethernet hub) shown in the middle of the cable. When a link is not established, the left half of the cable is not shown.

Clicking on the connector or device opens the *Logger Connection* dialog. As described in the previous chapter. Connections can be made, broken, added, deleted, or edited using this *Logger Connection* dialog.

LOGGER MODEL

When a connection is established, the connected Logger communicates back to HyperWare-II its Model number. The Logger graphic updates to indicate the model (IL-10, IL-20, IL-80)



CONNECTED INTERFACE MODULES

When the connection is established, the Logger also communicates back to HyperWare information about any additional Interface Modules that are connected to the unit via the BBus. Interface Modules (up to 16) are displayed graphically daisy-chaining around the bottom and up the left side and over the top of the Logger graphic.

Double-clicking on the module graphic will display information about the module, as described below in Interface Module Identification.

OVERLAYING ICONS

Upon establishing a connection between the PC running HyperWare-II and the Logger, icons representing different types of information will be displayed overlaying the Logger and the PC monitor images. These icons may be dragged and dropped between the PC and the Logger to activate various commands as explained in the following section.

GRAPHIC COMMANDS

Using the mouse, commands can be sent to a connected Logger by dragging and dropping (or double-clicking) icons as well as clicking buttons or other graphic images such as the Logger front panel buttons.

ICON DRAG AND DROP OPERATIONS

Clicking on an icon overlaying the Logger and dragging it over the PC graphic and then dropping it will transfer information represented by that icon from the Logger to the PC. Dragging icons overlaying the PC to the Logger function similarly but in the opposite direction. The icons are identified in Figure 7-2 and Figure 7-3.

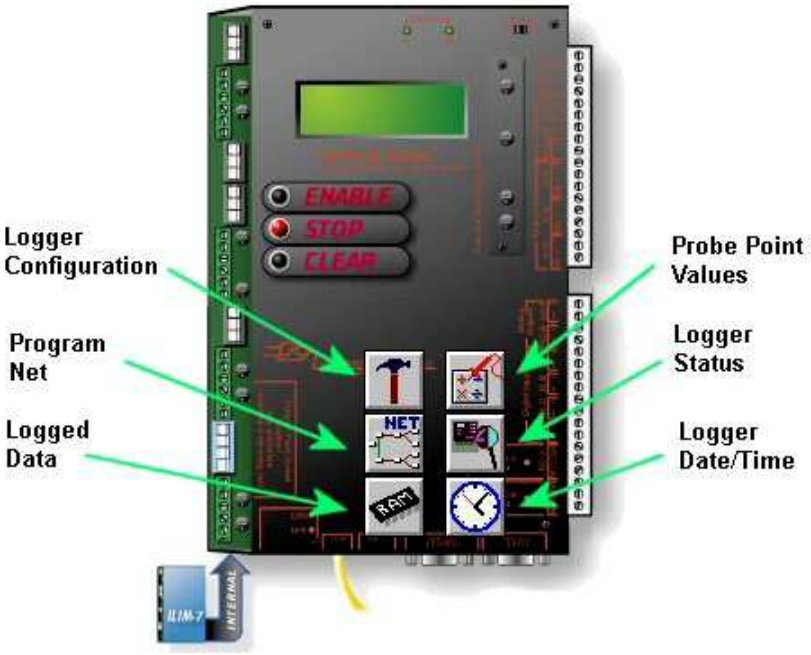


Figure 7-2 - Icons Overlaying Logger

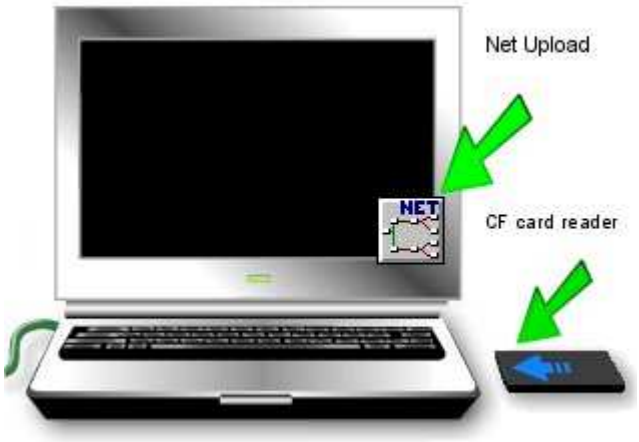


Figure 7-3 - Icons Overlaying PC

NET UPLOAD

Program Nets can be built within the Programming Window then uploaded from the PC to the Logger memory where they will execute. The Program Net icon overlaying the PC represents the Program Net that is currently open within the Programming Window.

Dragging the Program Net icon above from the PC image to the Logger image will cause HyperWare-II to attempt to load the Program Net from the Net Programming Window up to the Logger.

First the Program Net will be checked for things such as completion, integrity and matching the hardware configuration of the Logger and its modules. If there is some problem, the User will be notified by a pop up Warning dialog, highlighting the issue.

If the Program Net is valid for this Logger, HyperWare-II will display a reminder message stating that uploading the Program Net will erase data memory. If this is accepted, the following occurs:

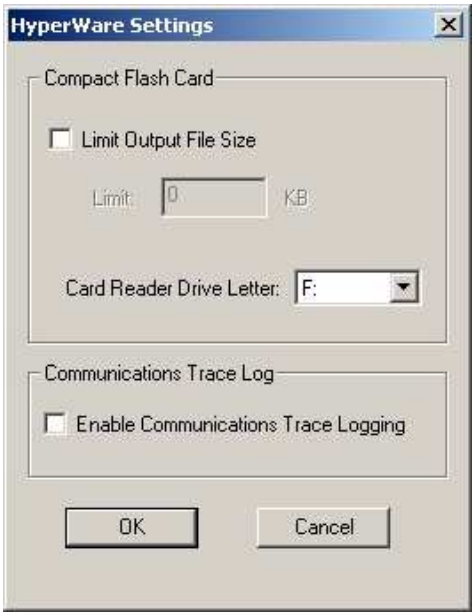
1. The logger execution will be stopped.
2. The Program Net from the PC (including Custom Web pages) will be uploaded, reprogramming of the Logger Program Net.
3. All logged data currently in the Logger memory or CF card will be deleted.

Once the Upload has completed, the Logger may be enabled manually or from HyperWare-II.

CF CARD READER

Double-clicking on the CF Card Reader icon causes HyperWare-II to check the card reader for Logger Data.

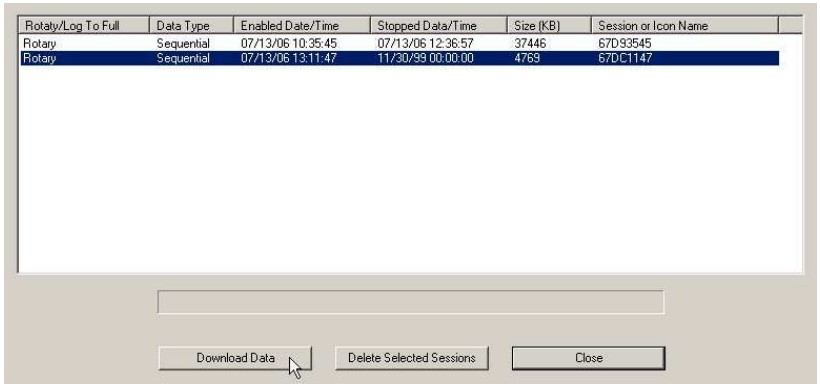
If a CF card reader is installed, but has no CF card in it, the warning *Card not installed* will be displayed. If a removable card reading device has been disconnected, a warning such as *Directory F:\Log was not found* may be shown. The HyperWare Settings dialog can be used to change the drive letter used by the CF card reader. This dialog can be accessed using the *HyperWare Settings* option from the *File* menu.



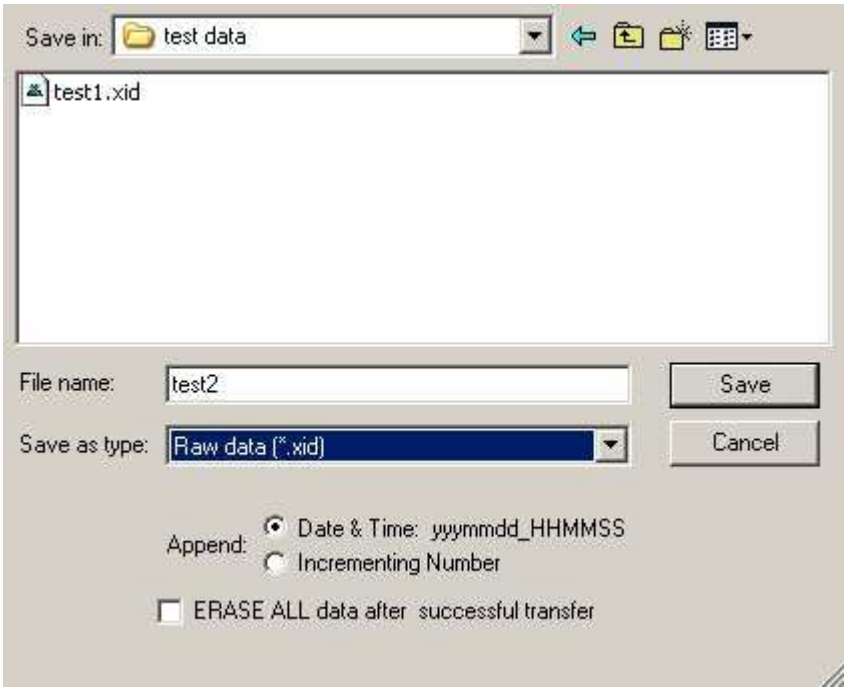
When a CF card is detected in the CF card reader, the corresponding CF card reader icon will be shown plugged into the PC image, and will be overlaid by a Memory icon.

Drag the CF Memory icon into the PC image, or select *Compact Flash Card – Download Data* to open the data download dialog, which provides access to the data stored on the CF card.

Highlight any session(s) you are interested in accessing.



Once selected, clicking on the *Delete Selected Sessions* button will erase that data from the CF card. Clicking on *Download Data* will display a File Save dialog, with some additional options.

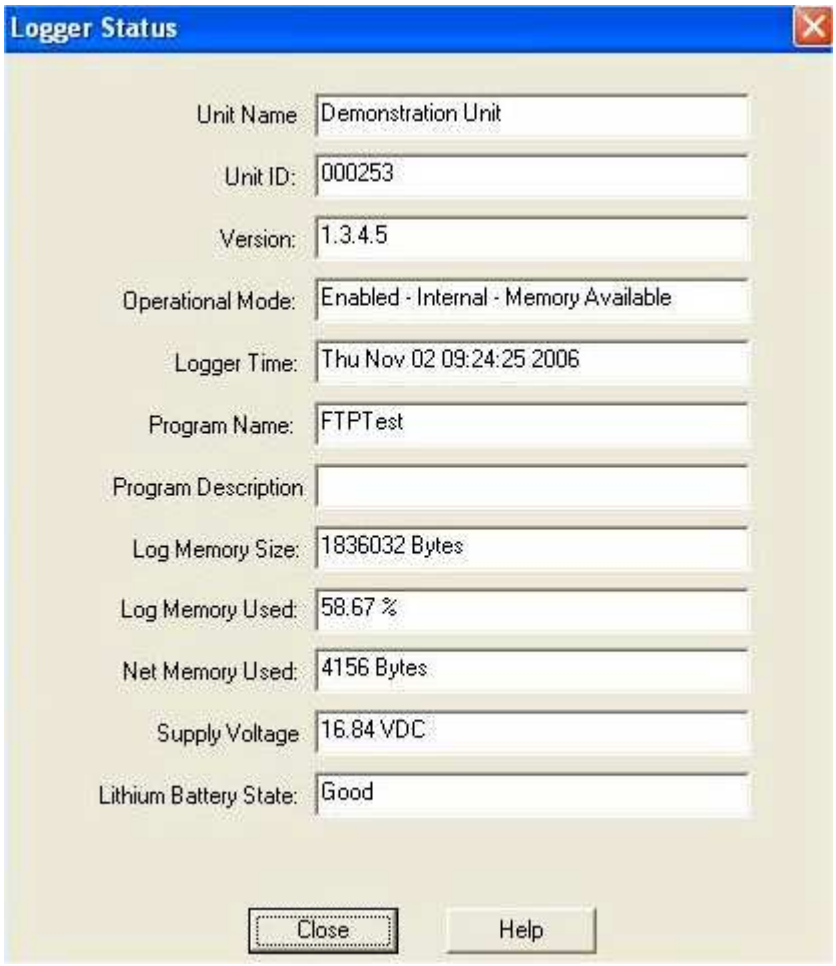


If more than one session is selected, radio buttons will be shown, offering two choices for distinguishing between the files generated for each session. The Chosen filename will have an entire Date/Time appended to it as each file is saved, or the User can choose to simply append a number that automatically increases with each file.

If the *ERASE ALL data after successful transfer* option is checked, the data will be deleted from the CF card after it has been downloaded to the PC.

SYSTEM STATUS

Dragging the System Status icon from the Logger to the PC opens a dialog with status information obtained from the connected Logger. Information includes the Logger's Name and ID, Version, Operational Mode, Program Net, Memory information, etc.



UNIT NAME AND UNIT ID

These values may be edited using the Logger System Configuration (described below), to differentiate each individual Logger.

VERSION

This is the version of the firmware currently loaded in the Logger. This is the core software that drives the Logger and allows it to respond to button presses, perform analog to digital conversions, communicate via a serial link and much more… including interpreting the Program Net that a user has designed and loaded into Logger memory.

The firmware can be updated in the field using commands within HyperWare-II allowing for future feature additions as well as bug fixes. This update process is called *reflashing* and is covered in the *Reflash* section below.

OPERATIONAL MODE

The Operational Mode indicates whether the Logger is enabled, downloading data, stopped or in some other mode. It also indicates whether the Logger is storing data to Internal Memory or to an external CF card, and gives a summary of memory usage. Greater detail on the amount of memory used and available is provided below.

LOGGER TIME

The Date and Time of a Logger may have been synchronized to a PC or adjusted to other time zones, etc. The Logger clock may be changed from the Communication Window. All timestamps for logged data use this “Logger Time”. This value only displays the Logger Time at the time the status dialog was opened. Logger time does *not* automatically change back and forth for Daylight Savings time, unless the user explicitly changes it.

PROGRAM NAME AND DESCRIPTION

These identify the Program Net currently loaded into the Logger. They may be edited by the User in the Global icon when building a Program Net. The Icon Name assigned to the Global icon is automatically used as the Program Name. The description is limited to 20 characters so that it can be displayed on the LCD screen.

MEMORY

The information provided here includes details about Data Memory as well as about Memory used to store the Program Net.

If the total *Log Memory Size* is less than 1,800,000 Bytes, the Logger is probably using Built-in RAM. Otherwise it may be logging data to a Compact Flash (CF) card. A certain amount of overhead space is reserved, which may vary from one Program Net to another, so *Log Memory Used* will never get up to *Log Memory Size,* even when full.

Net Memory Used gives a rough idea of the size of the Program Net, but not including any custom web pages and their images. To determine that, use the Memory Status of the Standard Web Pages of GreenWater™.

SUPPLY VOLTAGE AND LITHIUM BATTERY STATE

Two battery sources are monitored: the Supply Voltage which powers all the boards of the system, and the round Lithium battery mounted on the CPU to sustain Memory. If *Memory Backup Voltage* shows "LOW - Replace Battery" instead of "Good" tend to it promptly to preserve data integrity.

QUICK PROBES

Dragging the Quick Probe icon from the Logger to the PC opens a dialog that displays the current values of the various Probe Point icons in the currently executing Program Net.

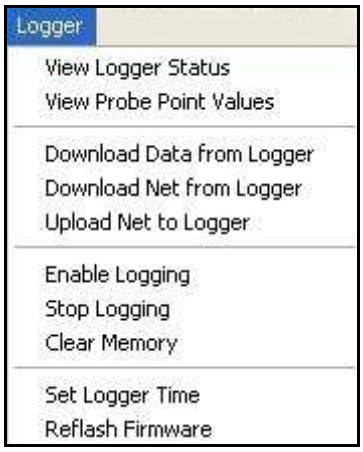
Probe Points
Logger Last Polled At:
Thu Nov 02 09:12:07 2006
Air Max 86 'F Thu Nov 02 10:13:18 2006
Air Min 90 'F Thu Nov 02 10:13:18 2006
Water Max 72.294472 'F Thu Nov 02 10:13:28 2006
Water Min 72.294472 'F Thu Nov 02 10:13:28 2006
Battery VDC 17.141136 Vdc Thu Nov 02 10:13:29 2006
Delta T 13.883354 'F Thu Nov 02 10:13:33 2006
Water Temp 72.294479 'F Thu Nov 02 10:13:28 2006
Wave height 0 Feet Thu Nov 02 10:13:29 2006
Air Temp 86.529274 'F Thu Nov 02 10:13:28 2006
Pause
Close

The columns are Probe Point Name, the value, units, and the time it was last sampled.

Although the screen polls the Logger and refreshes about every second, note that the values may only change when the clock that drives that Probe Point causes it to update its value. If the Sample Rate Clock only triggers a scan once every 5 minutes, even a one second refresh rate on Quick Probes will not display a fresh value until that 5 minutes passes.

DOWNLOAD DATA

Dragging this icon from the Logger image to the PC image opens the Data Download Dialog. Alternatively select the *Download Data from Logger* option from the *Logger* menu.



Please refer to Chapter 10 for more information about Downloading Data.

DOWNLOAD NET

When the Program Net icon is dragged from the Logger image to the PC image, a copy of the Program Net in the Logger is downloaded to HyperWare-II. The will be loaded into the Net Programming Window. If there was already a Program Net being edited in the Net Programming Window, a File Save Dialog will be shown allowing the Program Net being edited to be stored on the PC. If the File Save Dialog is cancelled, the Program Net is not saved as a file on the PC, but it will still be loaded into the Net Programming Window.

LOGGER CONTROL

The buttons on the Logger image on the Communication Window mirror the functionality of the physical buttons on the Logger itself.

ENABLE

Clicking the *Enable* button will start the Logger running its loaded Program Net. It automatically begins a new Data Session each time it is enabled. If the Logger is already running when this button is clicked, all that happens is that a gentle reminder is displayed for the User. Likewise, if it cannot be enabled because there is no valid net loaded, a reminder is displayed. If the Logger was stopped because memory is full, the Logger will be enabled just long enough to determine that, then automatically stop again.

STOP

While a Program Net is running, it may be halted by clicking on the *Stop* button. This will terminate the current Data Session.

CLEAR

Clicking this button will clear all of the data logging memory. If a CF card is being used, it will be cleared of all Logger data, but if it originally had other files (such as pictures) they will remain intact. If internal Memory is being used for data, then that will be cleared.

If the Logger is still running when it receives the command to clear Memory, it will erase all data up to the time of the request, and proceed to log new data.

SET LOGGER TIME

The Date and Time of a Logger may be synchronized to a PC or adjusted to other time zones, etc. The Logger Time is initialized from the Communication Window, by dragging the Clock icon from the PC image to the Logger image, or vice versa.

All timestamps for the data use “Logger Time.” The Logger time does **not** change back and forth in accordance with Daylight Savings automatically, because this would cause an overlap of timestamps within the logged data. If an attempt is made to change the time while the Logger is enabled, a friendly reminder will pop up, explaining why this is disallowed.

REFLASH FIRMWARE

The steps to update firmware code in the Logger are as follows:

1. Download the new firmware file onto the PC.
2. Connect to the Logger via HyperWare-II
3. Stop the Logger.
4. Retrieve all data, and a copy of the Program Net.
5. Reflash the code.
6. Reset Logger and reconnect.
7. Load a Program Net into the Logger.

DOWNLOAD THE FIRMWARE FILE ONTO THE PC

In order to update firmware there must be a copy of the new Logger code on the PC or LAN (local area network). To download the firmware file at no charge, visit:

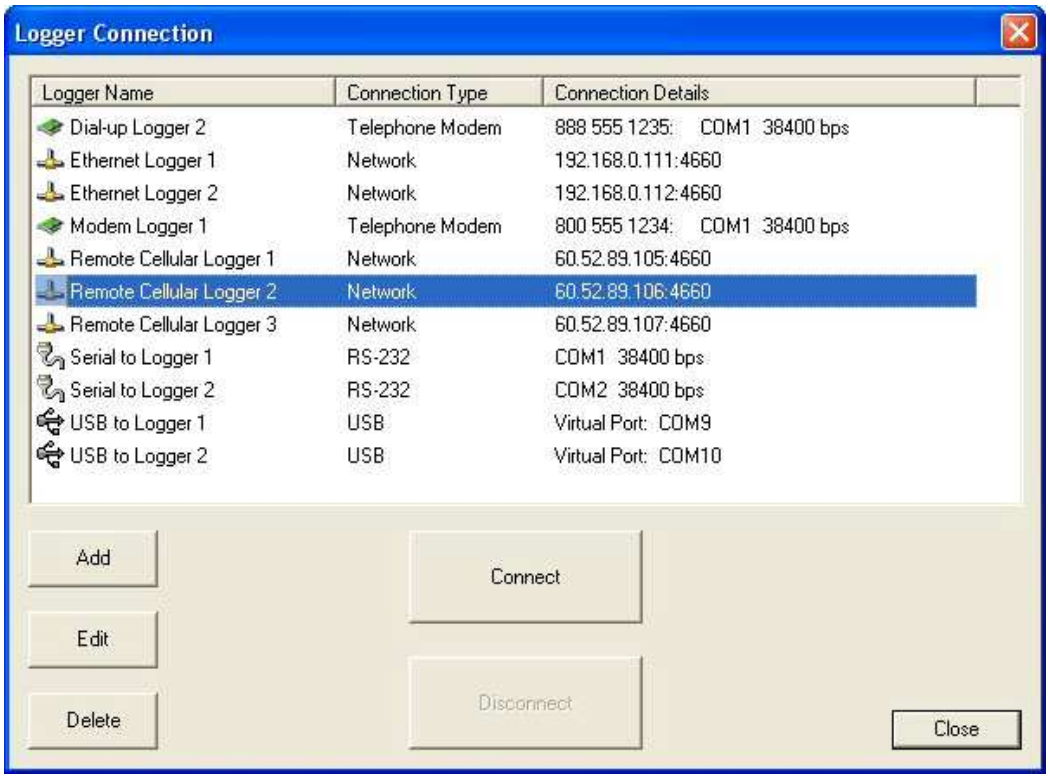
http://logicbeach.com/updates.htm

Look for the heading *IntelliLogger Firmware Downloads* and choose a file based on the Version Number or Release Date. Download the file and save it to a place that can be accessed by HyperWare-II.

CONNECT TO THE LOGGER VIA HYPERWARE-II

From the Communications Window, double-click on the graphic communication device showing at the end of the serial cable connected to the PC. Depending on the last communication method used, the device may be a multi-port hub, a DB-9 connector, or a modem.

A *Logger Connection* dialog will open displaying a list of available connections.



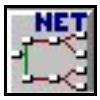
Almost any connection type can be used to Reflash the Logger firmware code. The one exception is a modem that is powered by an output in the Program Net. Obviously when the net is not running (or is being erased) it cannot power the modem.

STOP THE LOGGER

Stopping the Logger will end the Data Session.

RETRIEVE ALL DATA, AND A COPY OF THE PROGRAM NET

On the Communication Window of HyperWare-II, drag the Net and Memory icons to the PC image.



Dragging this icon from the Logger image to the PC image will allow a copy of the Program Net in the Logger to be saved to the PC.

Data should be downloaded before updating the firmware so that any data can be preserved before the reflash operation erases any logged data.

Although there are two ways to get the data when using a CF card, it is highly recommended that the CF card be read from the PC, because that method is so much faster than downloading the data. When a PC card reader detects valid Logger data, there will be a Memory icon shown on the card reader image. Simply drag the Memory (RAM) icon from the card reader image to the PC to open the Data Download dialog.

Dragging the Memory (RAM) icon from the Logger image to the PC image also opens a Data Download dialog, Passing data to the PC though via Logger messages is much slower for a CF card, but is the only way to get data from the Logger's internal on-board Memory.

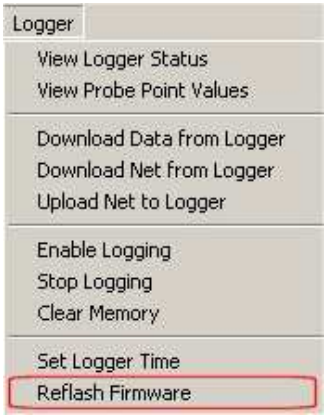
For either method, select all Data Sessions to be saved, then click on the Download Data button. This opens a File Save dialog that allows the user to enter a filename. It is highly recommended that this data be saved in *.XID format.

> **Note:** only **XID** format files can later be translated to other formats, viewed graphically, or checked for integrity.

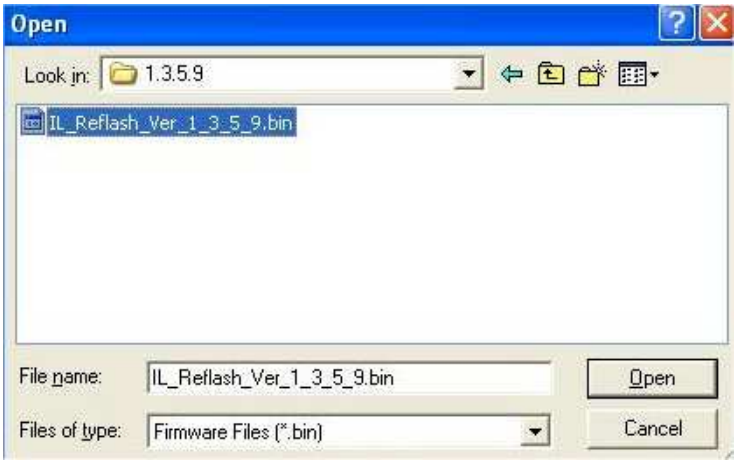
If there are multiple sessions, there will be a choice of what to append to the filename, so that each session will be given a unique filename. Refer to Chapter 10 (Downloading Data) if further explanation is required.

REFLASH THE CODE

Selecting the *Reflash Firmware* option from the Logger menu will begin the process of reprogramming the Logger with the new firmware.



Once selected, a File Open dialog will be displayed, allowing the User to select the firmware file to use.



After selecting the file and confirming the reflash operation, a progress window will be shown. Wait until the progress window displays *Reflash Complete.* Note that this process may take several minutes to complete.

RESET LOGGER AND RECONNECT

After the progress window displays *Reflash Complete,* it is safe to toggle power on the Logger. Cycling power while a reflash operation is in progress is not recommended.

LOAD A PROGRAM NET INTO THE LOGGER

Remember that this procedure has erased all data and Program Net information. A Program Net must be uploaded before the Logger can run again. To retrieve the Program Net that was saved prior to the reflash operation, go to the Net Programming Window, load the file (if it is not still loaded), then return to the Communication Window and Upload the net by dragging the Net icon from the PC to the Logger.

SYSTEM CONFIGURATION

There are system-wide Logger settings (not specific to a single net) that can be stored in the non-volatile System Configuration Settings of the Logger.

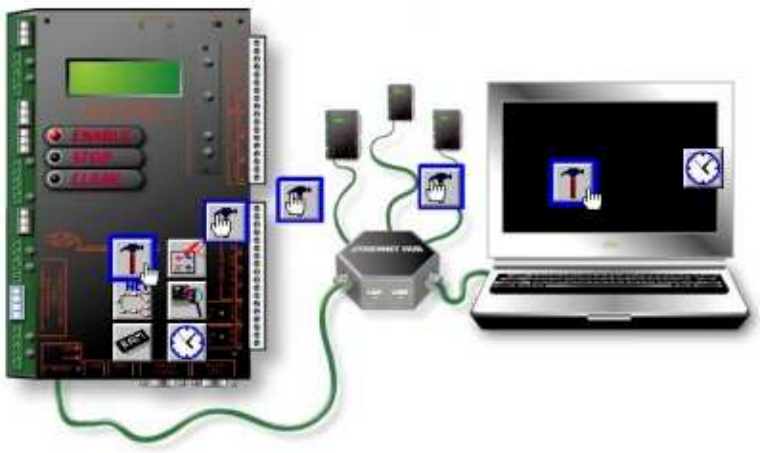
TO ACCESS THE LOGGER CONFIGURATION DIALOG:

Establish a communication link between the Logger and the PC. If Ethernet has not already been configured then USB or RS-232 should be used, as some of the settings within the Logger Communication dialog are required prior to establishing an Ethernet connection.

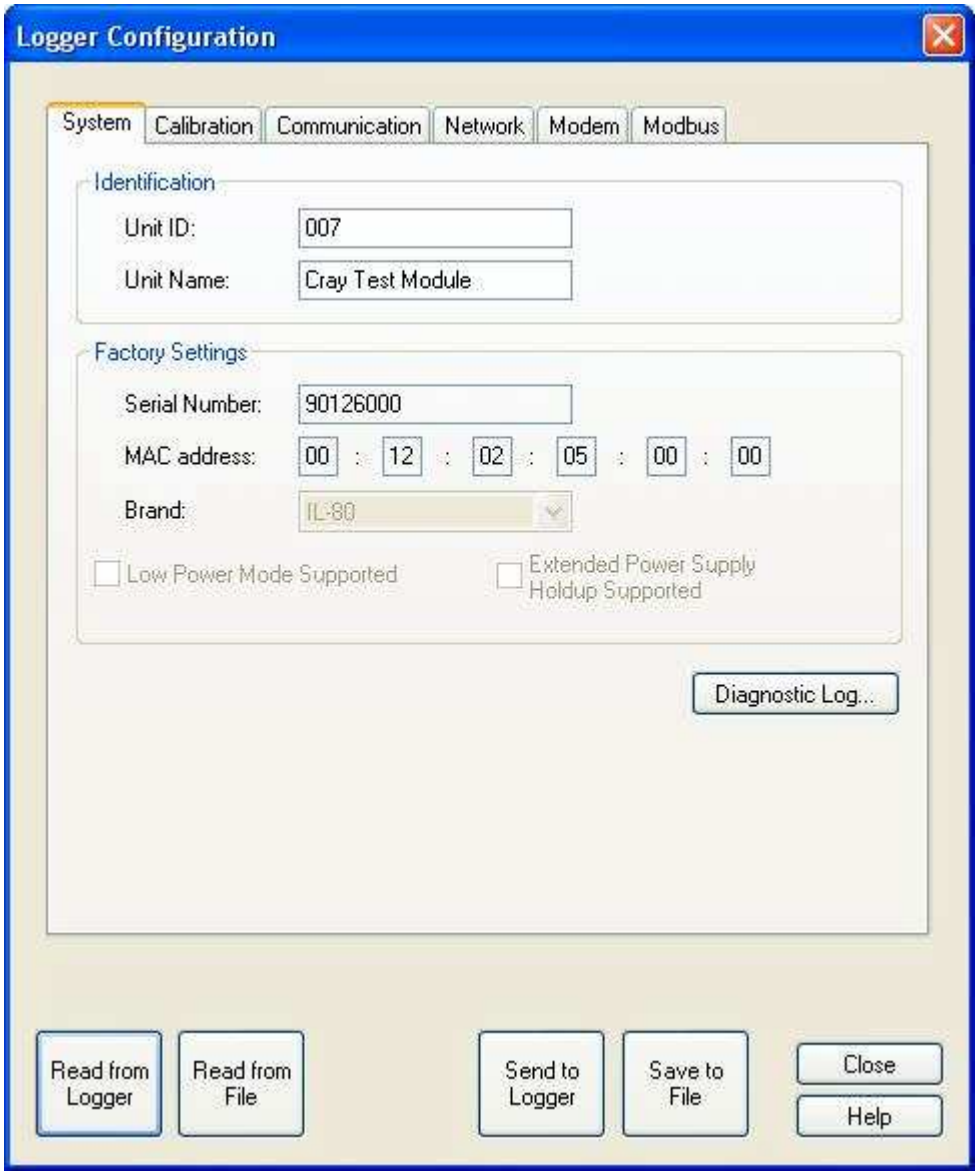
If Ethernet has been configured, then the System and Modem tab settings (described below) may be edited via a network connection.

One method for accessing System Configuration is to use the *Logger Configuration* option from the *Logger* menu in the Communications Window.

Alternatively, if there is a Logger already connected and stopped, drag the Logger Configuration icon (hammer graphic) that overlays the Logger front panel to the PC and release.



A Logger Configuration dialog will open and display five tabs… System, Calibration, Communication, Network and Modem. A sixth tab, Modbus, will be available if the Modbus option has been purchased.



SYSTEM TAB

The System Tab allows user setting of unit identification information, as well as viewing of the Logger factory programmed (and non-editable) Serial Number, Brand and MAC address.

Identification

Two text fields are provided for user entry of identifiers. These names will be incorporated into data files, the LCD menu structure, Status responses, Standard Web pages and other locations to assist in tracking the source of data. This is particularly useful when multiple Loggers are used.

Factory Settings

The Serial Number, MAC address and Brand are preset and cannot be changed. They are for informational purposes only.

SERIAL NUMBER
Like the Unit Name and ID, the unique Serial Number is used to identify the Logger in data files, the LCD menu structure, Status responses, Standard Web pages and other locations to assist in tracking the source of data.

MAC ADDRESS
The MAC address (Media Access Control) is a unique, non-changeable identification number assigned to most equipment connected to networks.

BRAND
This string identifies the specific brand. Some brands include the BBus expansion to additional interface modules, such as the ILIM-7, which has 8 isolated inputs per module. The Logger brand will be one of these Logger family members:

IL-10
Logger with 7 inputs, 7 outputs.

IL-20
Logger with 7 inputs, 7 outputs and BBus expansion capability.

IL-80
Logger with 8 isolated inputs, 7 standard inputs, and 7 outputs. Also includes BBus expansion capability to additional interface modules.

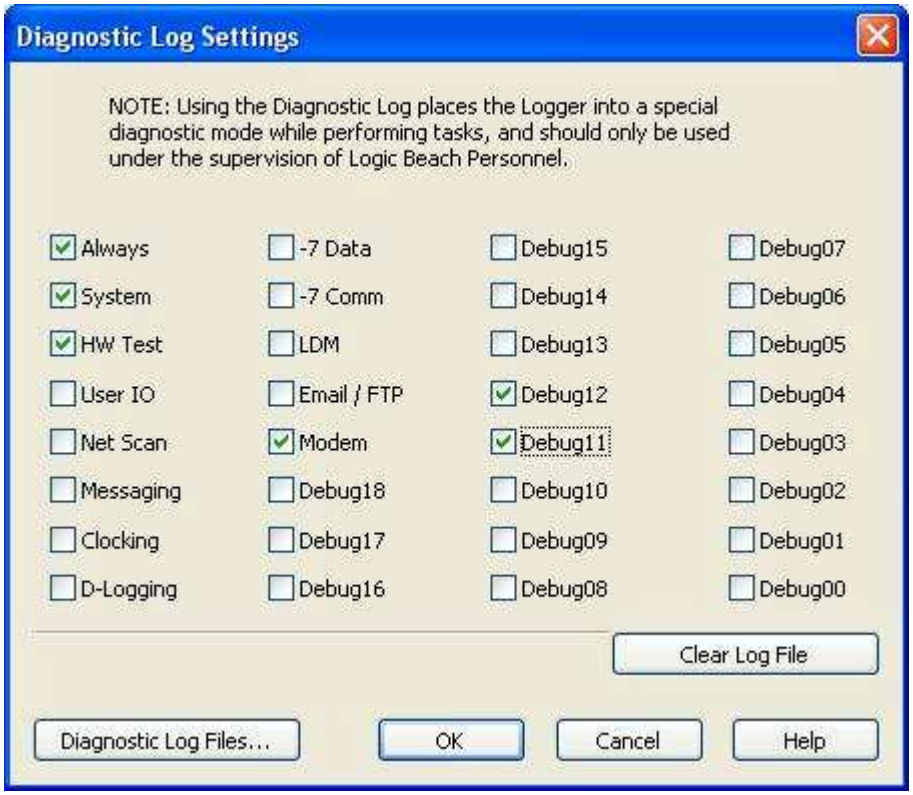
Diagnostic Log…

Clicking on the Diagnostic Log... button opens a dialog that provides access to the special Diagnostic Log Configuration Settings.

Diagnostic Log Settings

These settings are part of a special diagnostic log that are internal to the Logger, and should only be used under the guidance and instruction of Logic Beach personnel.

The settings at the top determine the amount of internal memory assigned to the diagnostic log. Disabled means that no memory will be assigned to the diagnostic log and it will use no resources, otherwise memory will be allocated away from the available internal logging pool.

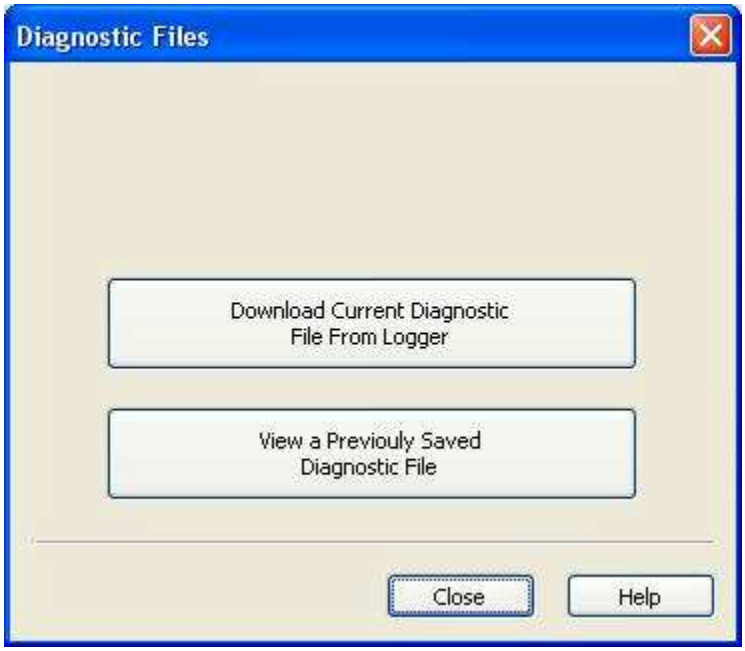


The settings shown have different meanings depending on the specific version of firmware being used.

To access previously recorded diagnostic files, or to save the current file to disk, click the Diagnostic Log Files button.

Diagnostic Log Files

This dialog provides the ability to download the current diagnostic log file from the Logger to a file for viewing or later analysis and also provides a means of selecting previously stored diagnostic log files to be viewed.

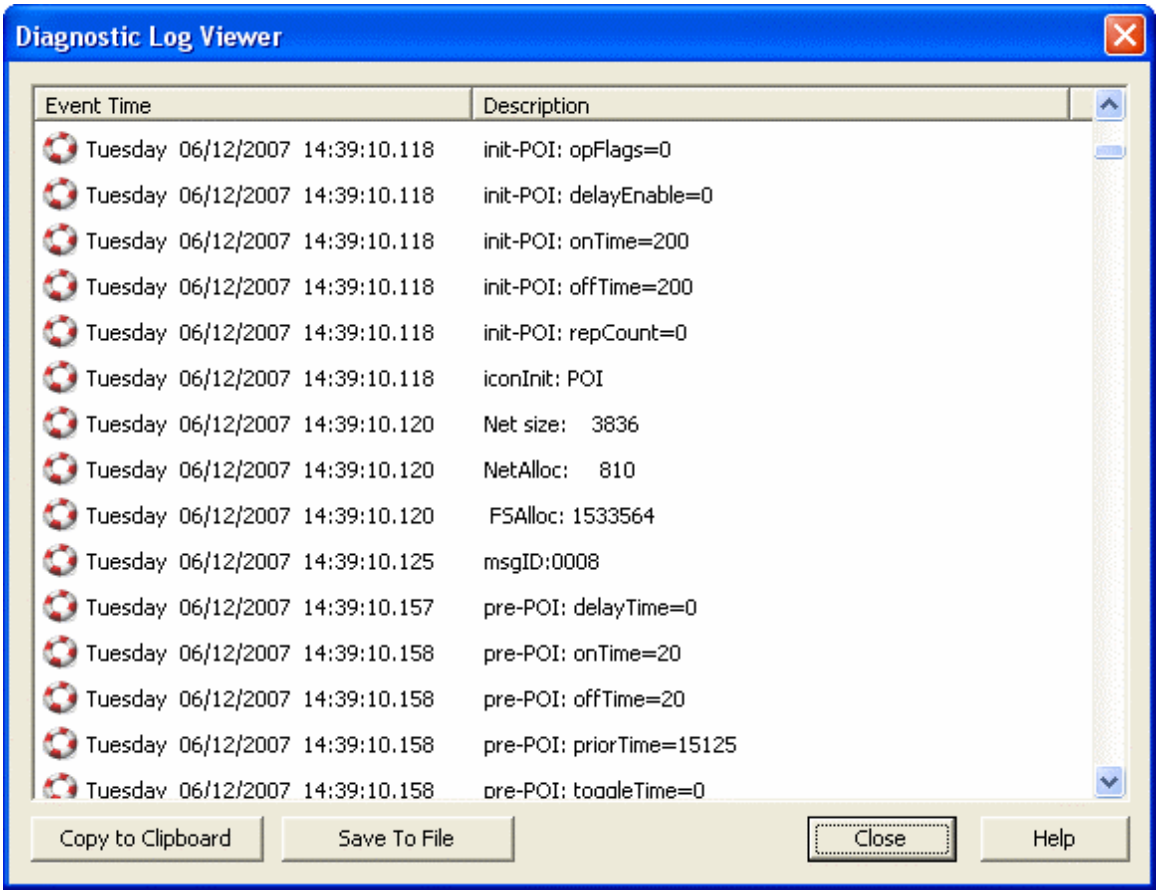


Clicking on the View a Previously Saves Diagnostic File button will allow the selection of a previously saved file for viewing. This will display the Diagnostic Log Viewing dialog.

Diagnostic Log Viewing

After selecting a diagnostic log file from the Diagnostic Log Files dialog, this dialog will be shown, displaying the contents of a previously saved diagnostic log file.

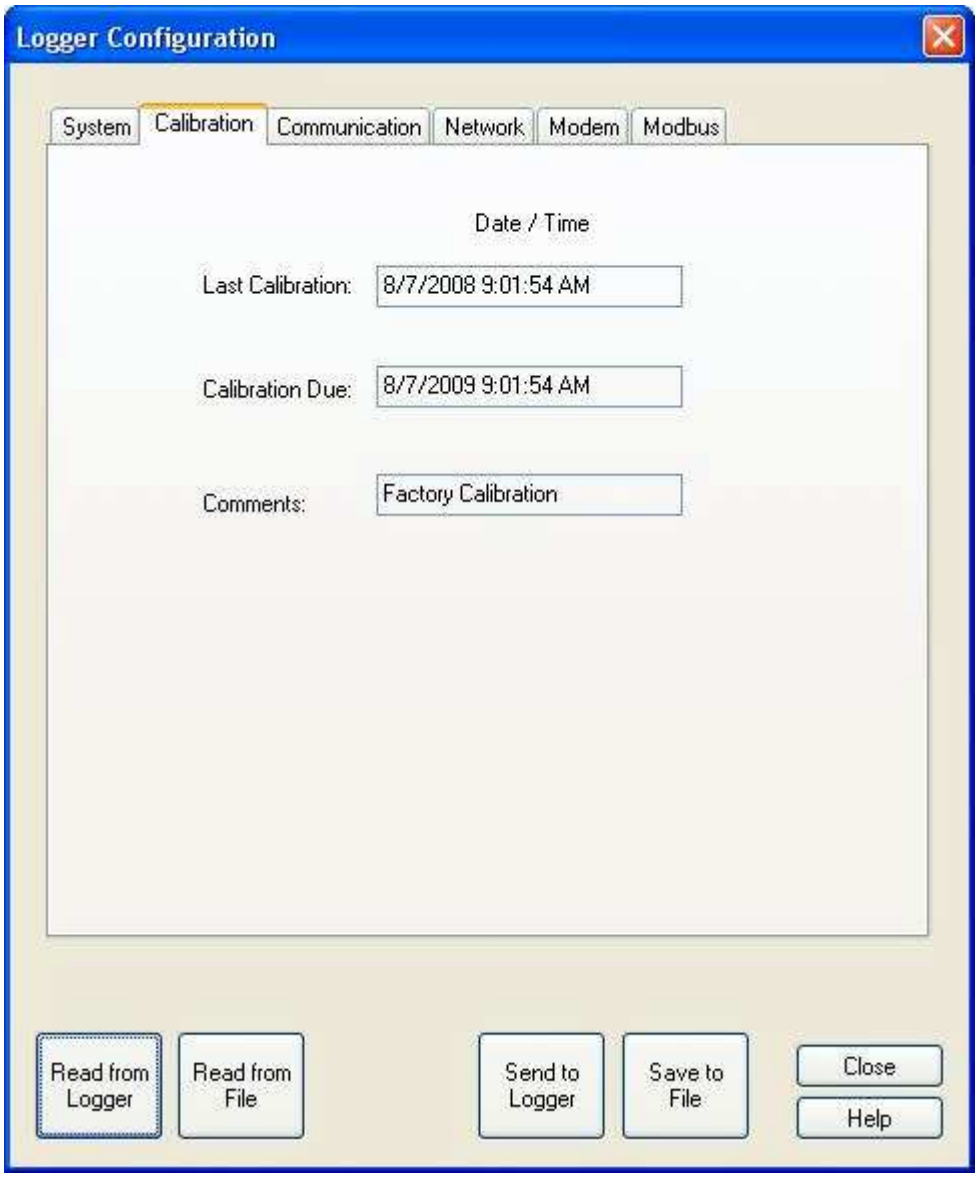
These log files can be used under the guidance of Logic Beach personnel to diagnose a number of issues in the field.


Diagnostic Log Viewer
Event Time
Description
Tuesday 06/12/2007 14:39:10.118 init-POI: opFlags=0
Tuesday 06/12/2007 14:39:10.118 init-POI: delayEnable=0
Tuesday 06/12/2007 14:39:10.118 init-POI: onTime=200
Tuesday 06/12/2007 14:39:10.118 init-POI: offTime=200
Tuesday 06/12/2007 14:39:10.118 init-POI: repCount=0
Tuesday 06/12/2007 14:39:10.118 iconInit: POI
Tuesday 06/12/2007 14:39:10.120 Net size: 3836
Tuesday 06/12/2007 14:39:10.120 NetAlloc: 810
Tuesday 06/12/2007 14:39:10.120 FSAlloc: 1533564
Tuesday 06/12/2007 14:39:10.125 msgID:0008
Tuesday 06/12/2007 14:39:10.157 pre-POI: delayTime=0
Tuesday 06/12/2007 14:39:10.158 pre-POI: onTime=20
Tuesday 06/12/2007 14:39:10.158 pre-POI: offTime=20
Tuesday 06/12/2007 14:39:10.158 pre-POI: priorTime=15125
Tuesday 06/12/2007 14:39:10.158 pre-POI: toggleTime=0
Copy to Clipboard
Save To File
Close
Help

Often the contents of these files are only useful to the engineering staff at Logic Beach, however they can prove very useful in tracking down elusive real-life problems.

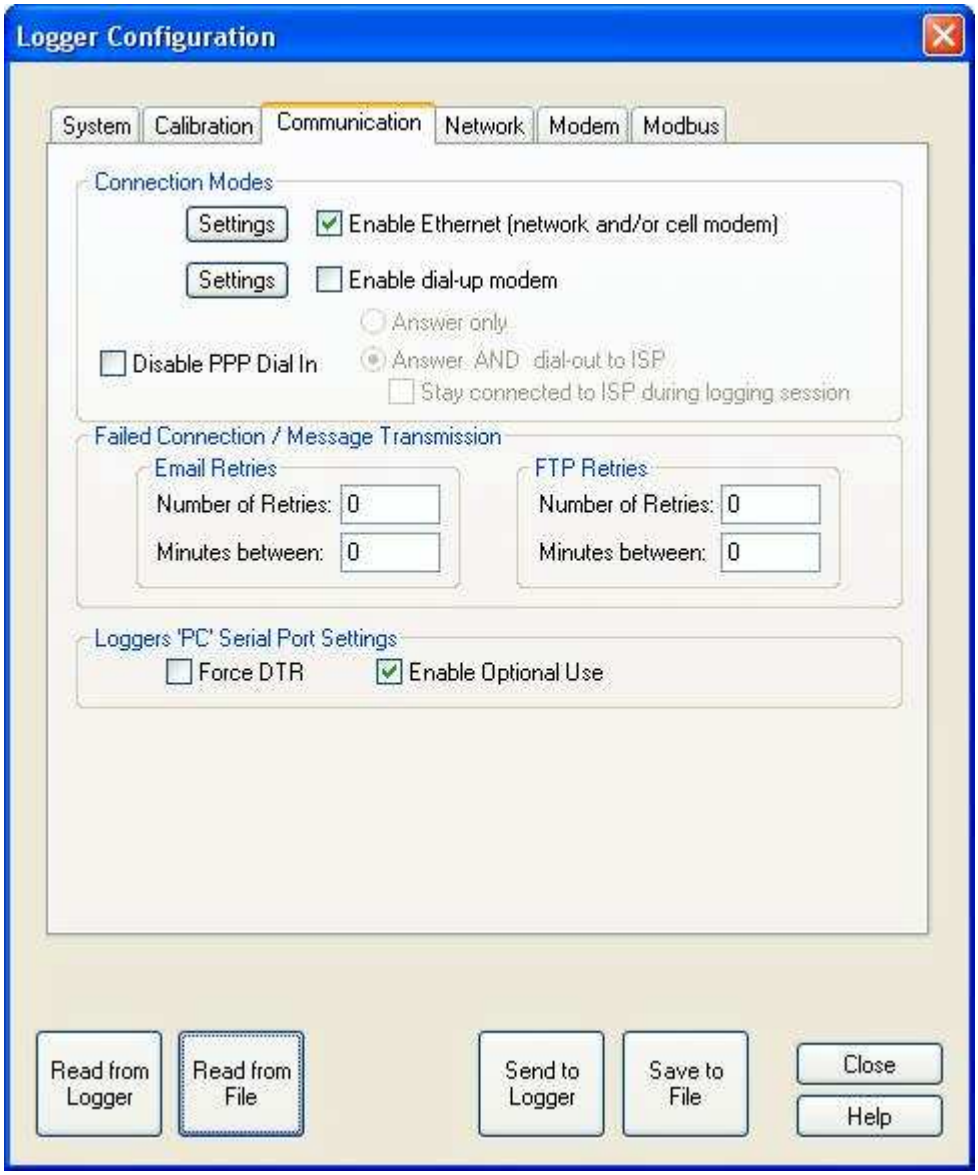
CALIBRATION TAB

The Calibration fields are provided for Metrology Department tracking of calibration dates and addition of any calibration related notes. These fields are used for informational purposes only.



COMMUNICATION TAB

The Logger provides multiple options for communication. Both Email and FTP can be sent using either Network or Modem connections. On this Tab the 'big picture' parameters are set.



Enable Ethernet/Enable Modem

For Email and FTP (File Transfer Protocol) icons to send anything out, at least one of these two *Enable* checkboxes must be checked. When both are checked, Ethernet will be used for outgoing message traffic, however the modem will only be used to respond to incoming calls. Disabling (unchecking) one of the two can help preserve battery life, and prevent unauthorized access.

Select *Enable Ethernet* for operations that will use an Ethernet network connection (i.e. Cat 5 cables, RJ45 connectors, and TCP/IP protocol). This also applies to cellular modem configurations, because the Logger interfaces with cellular modems using an Ethernet connection.

Select *Enable Modem* (PSTN) for operations that require a dial-up ISP (Internet Service Provider) connection. Such operations could include using Email or FTP (dial-out), or accessing the Logger from HyperWare-II (dialing-in).

Answer only / dial-out to ISP

When *Answer only* is selected, the modem will respond to incoming calls, but Email and FTP cannot be sent through the modem connection. When Ethernet is Disabled, the second Modem radio button (Answer AND dial-out to ISP) will be selectable, allowing Email or FTP message traffic to be sent through the modem, or to respond only to incoming calls.

Settings

The Settings… buttons automatically switch to the corresponding Network or Modem Tab allowing for additional corresponding configuration. Clicking these buttons is no different than selecting the other tabs manually, but are here for convenience.

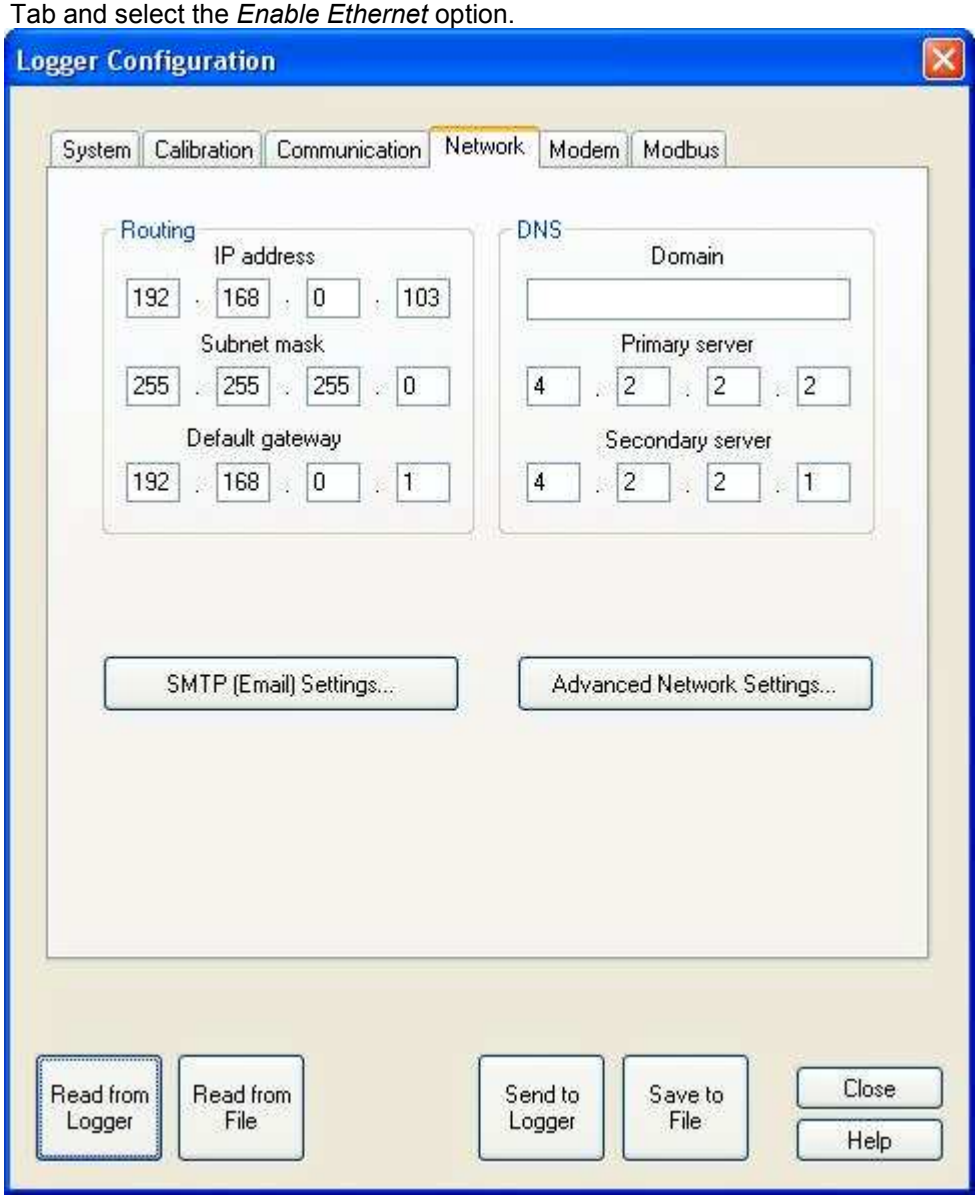
Email/FTP Retries

In the event that an attempt to send an Email message or an FTP data file is prevented for some reason, the Logger will retry at a later time. The *Number of Retries* setting defines the number of times the Logger will attempt to send, and the *Minutes between* defines the amount of time in minutes the Logger will wait between attempts.

NETWORK TAB

The Network page provides access to the network settings for the Logger as described below.

If everything on this Tab is disabled (or grayed), this could mean that the Ethernet option is disabled on the Communication page. To change this, switch to the Communication Tab and select the *Enable Ethernet* option.



Routing

Within the *Routing* section of the dialog are the IP Address, Subnet Mask and the Gateway settings. Assign values as required by your LAN (local area network) and/or per your Network Administrator's directions. If the Logger will be connected to the same LAN as your PC, the Subnet Mask and the Gateway settings may be obtained by looking at the Network settings for your PC.

IP Address
The IP address assigned to the Logger must be unique on the LAN and must be assigned by the person tracking all IP addresses currently in use by the LAN. It must be compatible with the Subnet Mask and Default Gateway.

Subnet Mask
Usually the first 2 or 3 segments are masked off (255), so that all IP addresses on the LAN only need to be unique in the low segment(s).

Default Gateway
A default gateway is a node (typically a router) on a computer network (i.e. your LAN) that serves as an access point to another network (i.e. the Internet). It could be the ISP that connects the user to the Internet, or a proxy server with a firewall.

DNS

Domain Name Server (DNS) settings point the Logger to a server that provides the translation of English names (e.g. logicbeach.com) to an actual Internet address in IP format (e.g. 111.222.333.44). Typically, your Internet Service Provider (ISP) or your Network Administrator will provide these parameters. If there is a PC on the LAN to which the Logger is being connected, the Logger can usually use the same values as the PC for these parameters.

Domain
The name your ISP or SMTP server recognizes as your LAN.

Primary Server
This is the IP address of the main Domain Name Server that is able to look up and resolve any domain name references the Logger may use.

Secondary Server
This is the IP address of the backup Domain Name Server, for use whenever the primary Domain Name Server is inaccessible.

SMTP (Simple Mail Transfer Protocol) Settings

The SMTP settings specify the Email server to be used by the Logger when sending Email. If the Logger is on the same LAN as a PC, the Email Server name and Port number may be obtained by reviewing the PC Email client settings.

SMTP Server
The Server name is typically in a format such as ‘smtp.yourmailserver.net’.

PORT
In almost all conventional applications, this Port is set to '25', or possibly '110', however any other number may be used up to a maximum port number of 65535.

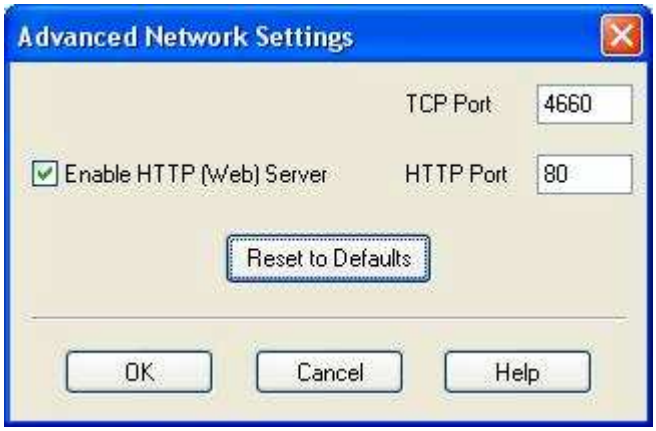
USE SMTP AUTHENTICATION
This must be checked if your SMTP server requires a secure login prior to sending emails.

USERNAME
A valid login name for your SMTP server. This is often your full Email address and should be assigned by your ISP or your network administrator.

PASSWORD
This is a password associated with the username and is required for authentication. Your ISP or network administrator would likely assign this at the same time as the password.

Advanced Network Settings

Well-known ports typically used by system-level processes include: FTP (21), TELNET (23), SMTP (25) and HTTP (80). However, if a firewall prevents access through the standard ports, it may be possible to establish a connection using a non-standard port. Ask your Network Administrator for assistance before changing these from default values.



ENABLE HTTP (WEB) SERVER
This checkbox provides the option to selectively enable or disable the Logger's internal web server functionality. This setting is enabled by default.

When unchecked, the web server is completely disabled, preventing anything from the Internet accessing the Logger's web server. The standard web pages will no longer be accessible with a browser or the GreenWater application.

TCP PORT
This is commonly set to 4660, but may be altered if directed by your Network Administrator, if the port number conflicts with other aspects of the network. This is the port number used when HyperWare connects to the Logger using an Ethernet connection.

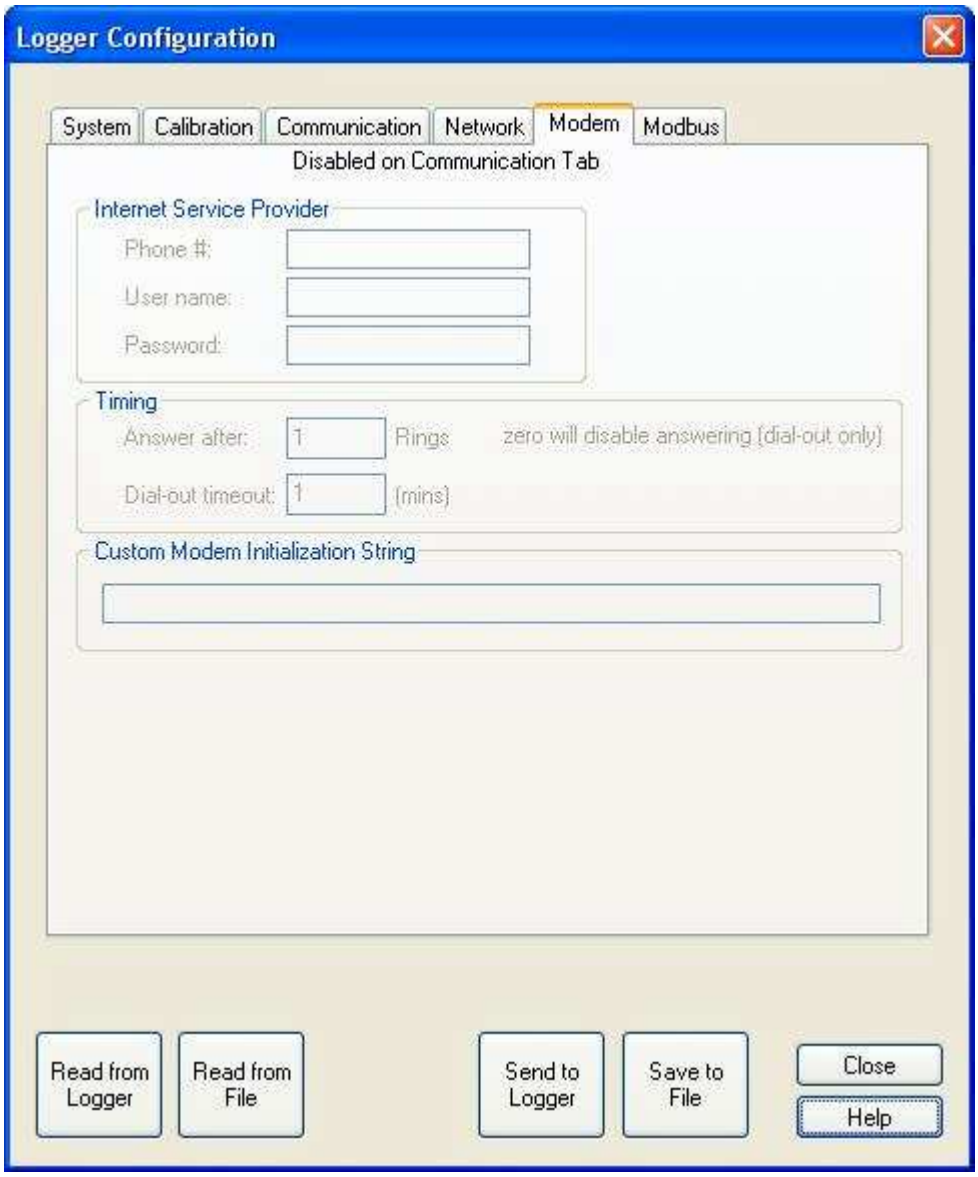
HTTP PORT
This is commonly set to 80, but may be altered if directed by your Network Administrator, if the port number conflicts with other aspects of the network. This is the port number used when a browser or the GreenWater application connects to the Logger using the web interface.

RESET TO DEFAULTS
Clicking this button will reset the TCP and HTTP Port values to their default values (shown above).

MODEM TAB

The Modem page provides access to the modem settings for the Logger as described below.

If everything on this Tab is disabled (or grayed), this could mean that the modem option is disabled on the Communication page. To change this, switch to the Communication Tab and select the *Enable Modem* option.



Internet Service Provider:

These settings provide the necessary information to allow a Logger to dial out to an ISP and establish an Internet connection. The following settings are typically provided by the ISP at the time that a dial-up account is established.

PHONE NUMBER

Enter the phone number of the ISP dial-up service. Some modems do not permit dashes, spaces or parentheses in the number. Some installations must first dial 9 for an outside line, or 1 for long distance. In these cases there will be a slight pause to get a dial tone. Insert commas into this number sequence to add pauses during dialing if needed.

USER NAME
Enter the exact username provided by the ISP for the dial-up account. Note that syntax and spelling typically must be exactly correct for log-in.

PASSWORD
Enter the exact password provided by the ISP for the dial-up account. Note that syntax and spelling typically must be exactly correct for log-in.

Timing:

When Ethernet is enabled on the Communication tab, *Dial-Out Timeout* is disabled.

ANSWER AFTER ___ RINGS:
The number of ring tones to receive before making connection. When this is set to zero, the modem will be out-going only, and will not answer any incoming calls.

Note: *Answer after 0 Rings* will prohibit in-coming calls.

DIAL-OUT TIMEOUT:
This is the number of minutes allowed for connection to be established before timing out.

Custom Modem Initialization String:

This is only used when the Logger dials out to an Internet Service Provider (ISP) for FTP or Email.

When this is left blank, the default value will be used. The default Modem Initialization string is "AT&FE0V1&D2&C1S0=0\V1S7=60S30=0\N3%C1 &K3B0N1X4" (where "0" is the number zero and not the letter oh). If the modem was purchased somewhere other than Logic Beach, check with the modem manufacturer for their recommended modem initialization string.

Command	Meaning
AT	Start command string
&F1	Reset to factory defaults
E0	Disable command mode echo
Q0	Send result codes
V1	Verbal result codes
X4	Enable all result codes
&D0	Ignore DTR
&K0	Disable data compression.
&M0	Disable error correction
&N6	Maximum speed is 9600 baud
&N4	Maximum speed is 4800 baud
&N3	Maximum speed is 2400 baud
&N2	Maximum speed is 1200 baud

MODBUS TAB

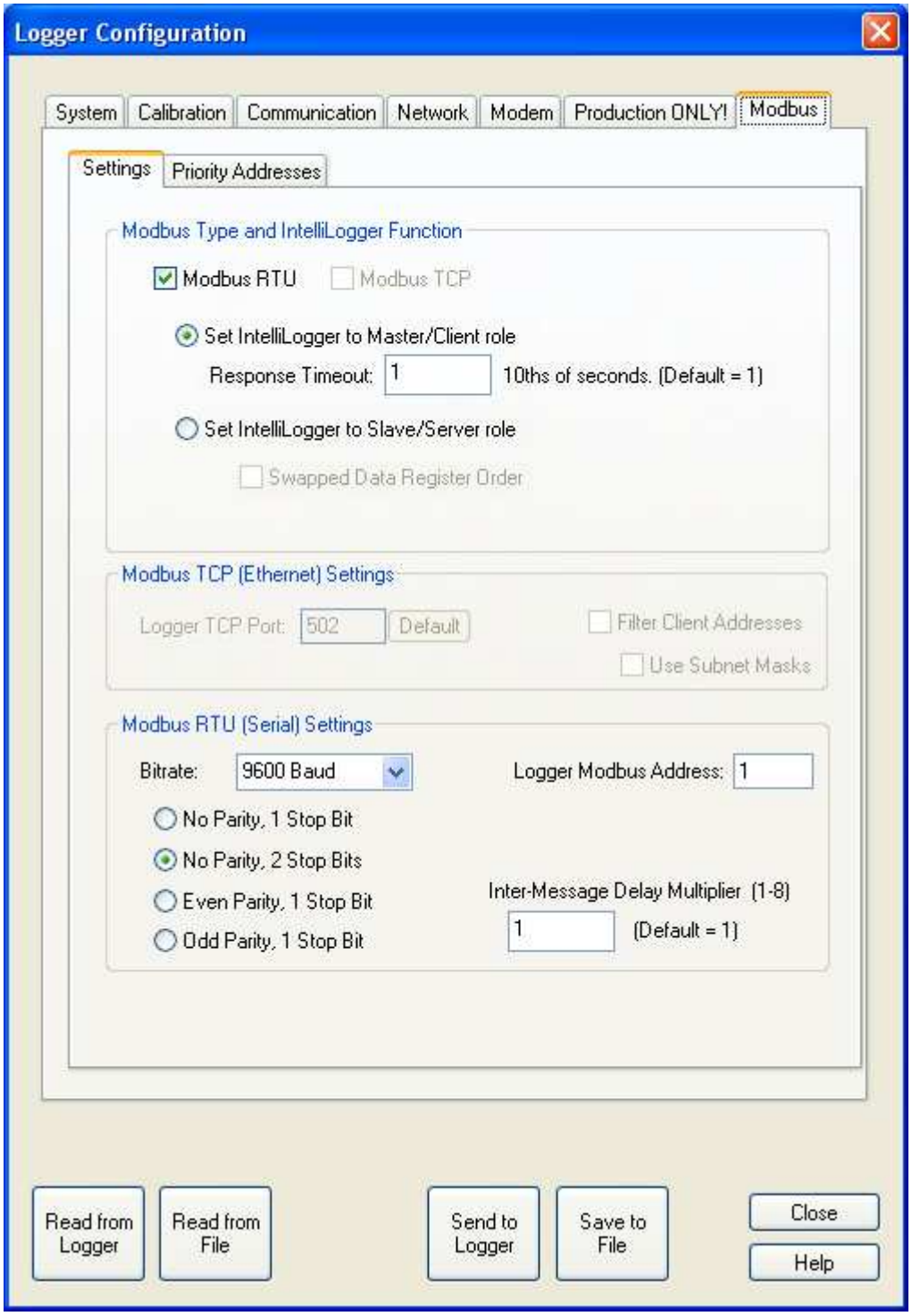
The Modbus Tab displays when connected to IntelliLoggers purchased with the Modbus option. This tab is used to configure the Modbus communication parameters for the available Modbus mode.

Currently, the following Modbus Modes are available as options for the IntelliLogger:

- Modbus RTU Master - the IntelliLogger can interrogate connected 'Slave' devices via RS-232 or RS-485 connections.
- Modbus RTU Slave - the IntelliLogger's Modbus registers can be interrogated by connected Modbus 'Master' devices via RS-232 or RS-485
- Modbus TCP Server - the IntelliLogger's Modbus registers can be interrogated by a connected Modbus 'Client' devices via the Ethernet port

Depending on the options purchased and the user selections, dialog sections will be unavailable (grayed out). Each of the Modbus Modes are described following with pertinent settings. Additional details on using the IntelliLogger with Modbus capability is included in Chapter 9

Modbus RTU Master



RTU / TCP

Specifies the connection type to be used in the Modbus network… Binary serial data (RTU) or TCP via Ethernet

RTU uses the IntelliLogger's RS-232 'PC' serial connection port. If the Modbus device communicates using RS-485, then the Logic Beach SCC-1, Serial Comm Converter, must be used to convert the IntelliLogger's RS-232 communication to RS-485.

TCP uses the IntelliLogger's Ethernet port to communicate to other Modbus devices on the network.

Set IntelliLogger to Master/Client or Slave/Server role

Select which role the IntelliLogger plays in the Modbus network.

Response Timeout

Allows the user to specify how many "10ths of seconds" the IntelliLogger should wait for a response from a Slave device after sending it a command. For example, with a value of 20, if the IntelliLogger sent a message to another device, it would wait for the reply for 2 seconds before giving up and moving on to the next message.

This feature can be used to force additional wait time for responses from Slave devices that may not respond quickly. Possible values are 0 – 255 and the default is 2.

Bitrate

Select the rate at which bits are sent during Modbus RTU communication. A dropdown menu allows the user to select among the most typical bitrates, including 1200, 9600, 19200, or 38400 Baud.

Note: Every Modbus device connected to the IntelliLogger must be communicating at the same bitrate. Not all devices communicate at more than one bitrate, refer to the individual device manuals for what bitrates are possible.

Parity and Stop Bits

Parity is a type of simple error checking used in serial communication. Stop bits are used in serial communication to signal that the current message is over. Refer to the individual device manuals for what type of parity and what number of stop bits is necessary for proper serial communication. Note that this is a global setting and all devices on the Modbus network must utilize the same Parity and number of Stop Bits.

Inter-Message Delay Multiplier

Increases the delay time between messages being sent to a Modbus Slave device. Acceptable values range from 1 to 8. Some Modbus slave devices are unable to communicate as fast as is specified by the Modbus standards. By increasing the delay time between messages being sent to the device, additional time is allowed for slower Slave devices to process messages and respond.

Modbus RTU Slave

Logger Modbus Address

Defines the IntelliLogger Modbus address. Each device on a Modbus network must have a unique Address. Valid addresses are from 1 to 247.

Swap Data Register Order

Only available if the IntelliLogger is in Slave/Server mode. This is in case the connected Master/Client device expects the data registers provided by the IntelliLogger to be in reverse order.

Modbus TCP Server

Logger TCP Port

The Modbus TCP connection uses the default network port of 502 to communicate with other devices, however this port number can be changed as needed.

The port can be assigned virtually any valid number in the range 1 to 65535, however this port number must not conflict with the HTTP port setting (normally port 80) or the main TCP port setting (normally port 4660) for the logger.

Filter Client Addresses

This gives the user access to the “Allowed Addresses” tab. See below for details.

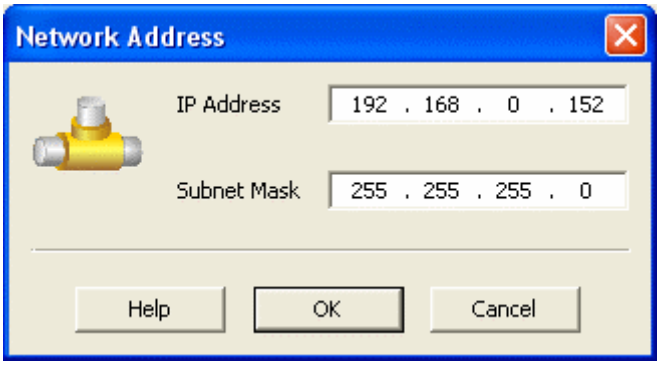
Use Subnet Masks

Selecting this checkbox switches the Address Table (see below) from a list of 16 IP addresses to a list of 8 IP Address/Subnet Mask pairs, allowing ranges of addresses to be specified.

This is a more advanced configuration and requires a good understanding of network addressing standards before use.

Network Address Dialog

The Network Address Dialog is used to enter IP address and Subnet mask pairs into the Address Table. To access this dialog, select the IP Address and Subnet Mask pair that you want to change and click the “…” button that appears to the right of the pair.



Allowed Addresses

Using these settings, it is possible to configure the security settings of the Modbus TCP connection, limiting the accessibility of the Logger to only a specified number of outside IP addresses.

These addresses can be specified as simple IP addresses, or may be specified as IP addresses and Subnet mask combinations, as determined by the Use Subnet Mask checkbox (described above).

If using simple IP addresses, there may be 16 addresses specified.

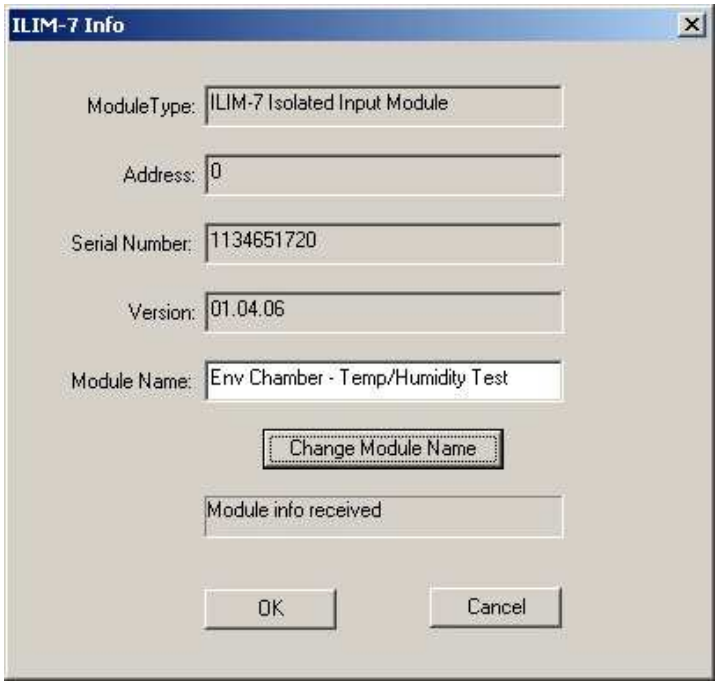
If using IP addresses and Subnet masks, 8 pairs may be specified.

Priority Addresses

In addition to these specified addresses, there may be up to an additional 8 "Priority" addresses assigned to the Logger. These are IP addresses that will be given priority connectivity to the Logger.

INTERFACE MODULE IDENTIFICATIONS

Double-clicking on the module graphic will display information about the module connected to the Logger via BBus.



MODULE TYPE

The ILIM-7 module has 8 differential, isolated bipolar analog 15+ bit input channels.

ADDRESS

Valid address numbers are 1-15 on the BBus. The module address is set via DIP switches.

Note: Address zero is reserved. It must not be used on the BBus.

SERIAL NUMBER

The Serial Number is a unique identifier, set at the factory.

VERSION

The version of firmware code loaded into the Module.

MODULE NAME

The only parameter the User can set through HyperWare is the name of the module. After entering or changing a module name, it is important to remember to click on *Change Module Name* to make the new name take effect. The name is limited to 31 characters.

8 ICON BASED PROGRAMMING

OVERVIEW

The Logger operates in the field based on a program loaded into its memory called a Program Net (Figure 8-1). The Program Net provides instructions for the Logger, including which channels to sample, when to sample, how to process the incoming signals, when to Output email alarms, and much more.

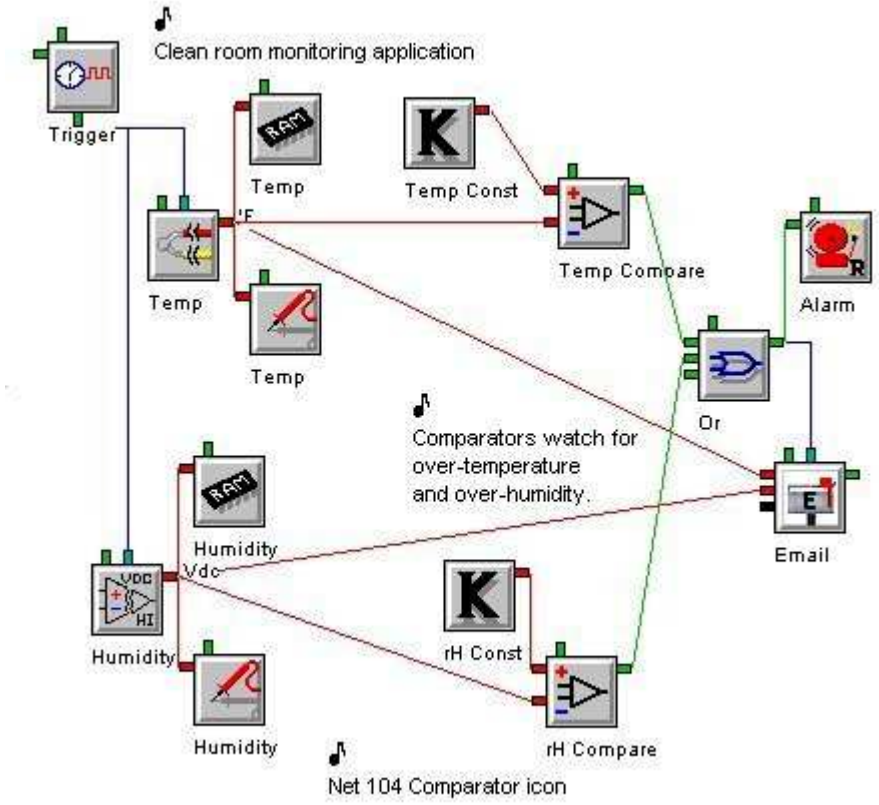


Figure 8-1; Sample Program Net

Development of a Program Net is done on a PC running HyperWare-II. After development, the Program Net is uploaded directly to the Logger memory one of the available communication connections.

Actual development of the Program Net is performed in the HyperWare-II Net Programming Window and the transfer of the Program Net from the PC to the Logger is performed from within the Communication Window.

Program Nets are developed through the following sequence of steps:

1. Poll Hardware to display all the Input/Output icons for the connected Logger. This can be saved to disk as a Program Net.
2. Add desired functions to the Program Net by dragging various icons from the Icon Palette onto the Program Net workspace.
3. Add connections between icon terminals indicating signal flow.

4. Configure the various icon options (e.g. Celsius or Fahrenheit, type of thermocouple, filtering, equations, math, set-point values, etc).
5. Save the Program Net to disk and/or transfer it to a connected Logger for execution.

This chapter describes the Program Net development environment and provides detailed instruction on constructing Program Nets. Detailed icon configuration information is provided in the Program Net Palette Icon Reference in Appendix A, the System Base Icon Reference in Appendix B and the ILIM-7 Module Icon Reference in Appendix D.

AN EXAMPLE PROGRAM NET

A simple Program Net is shown in Figure 8-2. In this Program Net, two thermocouples (Temp IN, Temp OUT) across a heat exchanger are sampled periodically, with the period determined by the Sample Rate Clock connected to the top of each of the Thermocouple icons. Their values are stored in Logger memory (RAM chip icons) and Probe Point icons (for Real-Time monitoring). Additionally, the difference between these two thermocouple channels is calculated (by the Math icon) and stored in Probe Point and Memory Icons (Delta Temp).

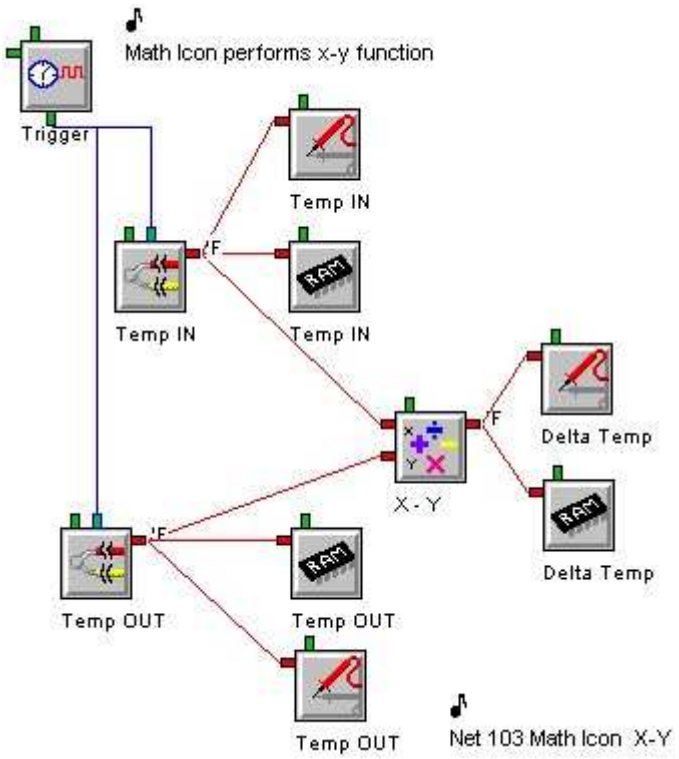


Figure 8-2; Heat Exchanger Example Program Net

NET PROGRAMMING WINDOW

Enter the Net Programming Window from any other window within HyperWare-II by clicking on the button at the upper left of the button bar. The Net Programming Window will open (Figure 8-3) displaying a blank development window with only the Icon Palette (described below) and Global icon, or with the Program Net currently in development.

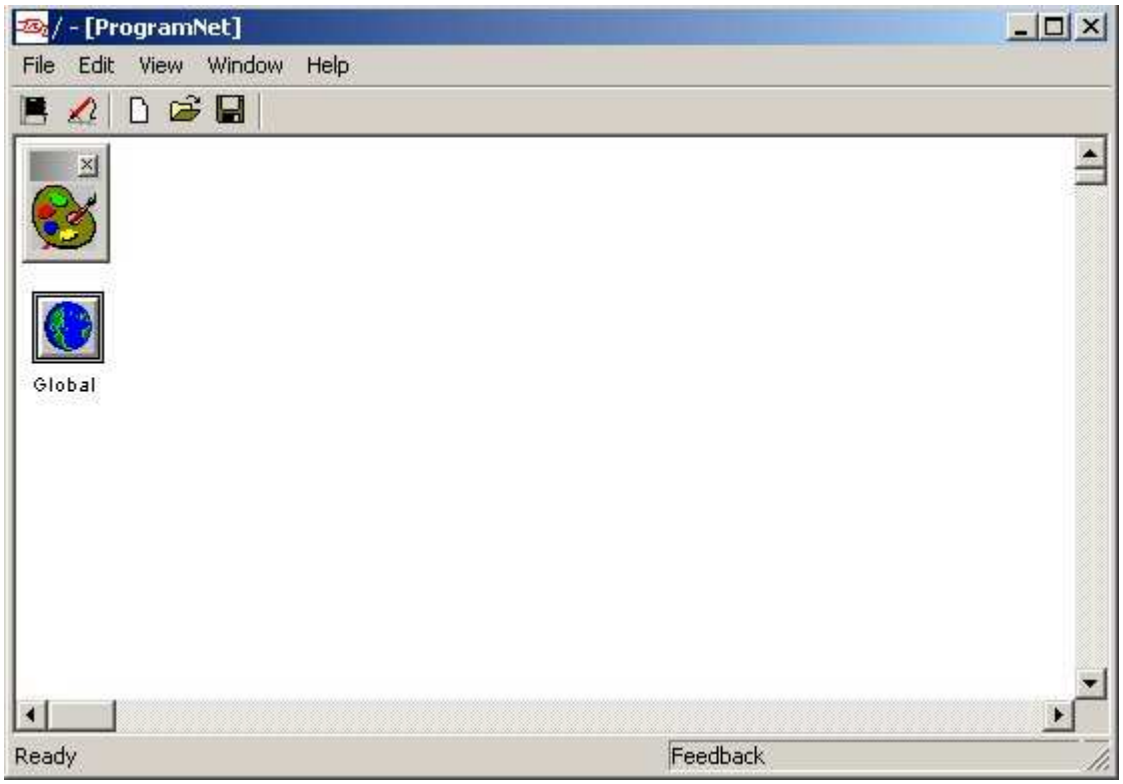


Figure 8-3; Blank Programming Window

OPEN NET AND SAVE NET BUTTONS

These buttons are provided to provide access to Save the Program Net to disk or to Open previously saved Program Nets from disk.

> **Tip:** Users that have a number of Loggers in use may find it convenient to create a subdirectory for each of the Loggers or configurations with which they work.
>
> Subdirectory names may correlate to the Logger ID or Unit Name which are User-programmed (See Chapter 6 for details of the Logger System Configuration Settings). As Program Nets are developed for each Logger or configuration, they can then be saved into the corresponding subdirectory.

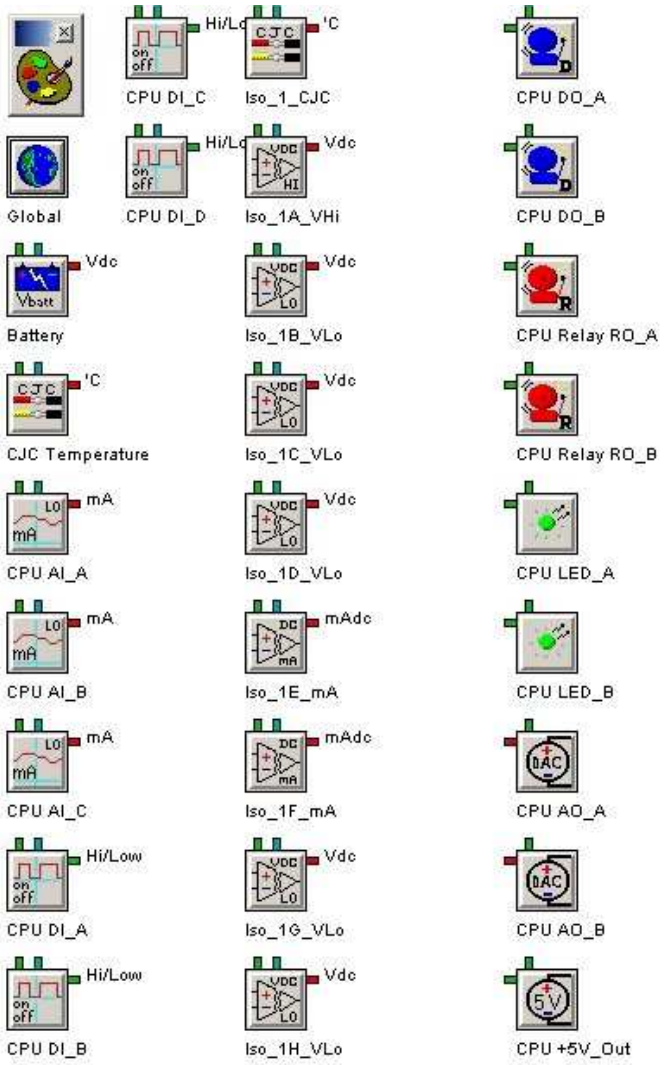
A Program Net with only unconnected Hardware icons should be saved to disk for each unique Hardware Configuration, by clicking on the *File - Save* button or using the *File - Save Net As* selection from the menubar. This unconnected Program Net can then be used as a

starting Net for development of varying Program Nets based on the same Logger configuration.

As Program Nets are developed, they should be saved with a filename different from this basic Program Net. Use the *File - Save Net As* drop-down menu to save Nets with different filenames.

POLL FOR HARDWARE (NEW) BUTTON

Clicking on the New Net button will automatically query the connected Logger to Poll for Hardware, then update the Programming Window with icons representing the connected Logger's hardware configuration, including any User-installed modules and options.



Tip: Save this hardware configuration as a Net, to build from later

PROGRAM NET CONSTRUCTION

Program Nets are developed in the Net Programming Window and saved as files with the filename extension *.NT2.

Program Nets must be developed to match the existing hardware installed in the target Logger. For example, a Program Net that uses an Input icon will only work in a Logger that has a corresponding Module and Channel.

Attempting to upload a Program Net that does not match the target Logger hardware configuration causes a configuration mismatch error to display, and the upload will not occur. This checking of compatibility is handled automatically within HyperWare-II during the upload process and insures that hardware and software compatibility exists.

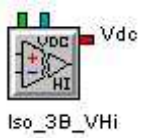
CONFIGURATION DETAILS THAT MUST MATCH INCLUDE:

Interface Modules

Program Nets must match the installed Interface Module types (i.e. ILIM-7).

Address

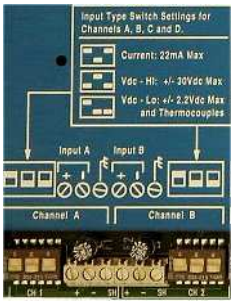
The Address used in the Program Net and the Address used for an Interface Module in the Logger must match. In the figures below, the Address of the icon is 3, but the Address of the Module is 0.



Channel Configurations

Interface Modules equipped with hardware configuration switches must have their switches set to match the Program Net on a channel by channel basis.

For Example: If an ILIM-7 is installed at Address 3, and has the Channel B configured (via hardware configuration DIP-switches) for Vdc-HI, then any Program Net loaded into the Logger must have Channel 3B used as a Vdc-HI channel (or optionally, not used).


Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - HI: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Input A
Input B
Channel A
Channel B

Iso_3B_VHi

System Configuration

If Ethernet and Modem are both disabled, Email and FTP icons will not be able to function.

ICONS

Program Nets consist of interconnected icons. Below is a partial listing of Hardware and Palette icons available for Program Net construction. For a complete listing and detailed explanation, refer to Appendix A (Palette Icon Reference) and Appendix B & D (Hardware Icons).

Input	Output	Processing	Special
CPU Adc	CPU 5V	Average	Email
CPU battery	CPU DAC	Compare	FTP
CPU TC	CPU Digital Output	Delay	Global
CPU V low	CPU Relay	Delta	Probe Point
CPU CJC	CPU LED	Duty cycle	Sample Rate Clock (SRC, trigger)
CPU digital GPDI	Histogram	Filter	Stop
Iso Adc	LCD text - Event	Flip-flop	Text notes
Iso CJC	LCD text - Status	Integrator	WEB
Iso TC	RAM	Latch	
Iso V high		Logic (AND, OR, NOT, XOR)	
Iso V low		Math	
Constant		Min/max	
Control switch		Multiplexer (Mux)	
Control variable		Rate of Change	
Periodic Output (POI)		Sample count accumulator	
Scheduler		Stopwatch	
Start/stop clock		Sum	
Warmup		Time counter	
		Warning	
		Window compare	

ICON TOPOGRAPHY

Icons share many similar features including their graphic appearance (Input and Output terminals, etc) and configuration techniques. All icons (except the Global, Web and Text Note Icons) have terminals for the addition of signal connections. Figure 8-4 shows the topology of an icon with its various terminals.

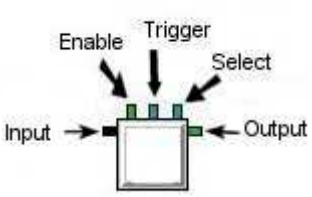


Figure 8-4; Icon Terminals

Terminals on the left side are Inputs, and the ones on the right side are Outputs. Across the top are three Control Terminal positions, but no icon has all three at once. They are, from left to right, the Enable, Trigger and Select Terminals. Only Trigger is edge-triggered.

Green Terminals indicate Logic (High / Low) values transmitted between icons. Logic signals have only two states, and can be used either as data or as control signals. Red Terminals represent Analog data only. Black Terminals can be attached to either type, and will change color to match as they are connected.

Input Terminals

On the left side of the icon are typically one or two Inputs for Logic or Data signal types. Data enters the icon for processing through these Input terminals. Some two Input icons (e.g. Math) do not require signals to be connected to both Input terminals for operation.

Output Terminals

On the right side of the icon is the Output terminal. After processing of an Input signal(s) is completed, the Output is updated. Depending on the type of icon and the User configuration, this Output terminal may or may not be updated every time the Trigger and/or an Input terminal is updated. The Enable Input (description follows), the type of processing that the icon performs, and User specified parameters within the Configuration dialog all effect when the Output terminal is updated.

For example, when using an Average icon, the Output terminal will only be updated with a new value after a User specified number of Inputs has been averaged.

Enable Terminal

The Enable Terminal can be left unconnected, or connected to any Logic signal (Green output). When a connected Enable Terminal goes Low, it disables the processing of Trigger Pulses.

Note: if the Enable Input is not connected, it defaults to the Enabled state.

A simple application of the Enable Input might be in an engine temperature recording application. A Thermocouple icon may be enabled / disabled by a Logic signal that is High when the engine ignition is ON. With this configuration, temperature recording will only occur when the engine is running.

The Enable Input can also be used for optimizing the speed of Program Nets and/or minimizing the amount of data collected as the processing normally done by an icon in a Program Net is not performed if the Enable Input is Low. For example, a Program Net may be built that has several Input temperatures that are scanned on a fairly high-speed basis. By use of the Enable terminal, the data flow to Logger memory may be disabled during normal operating conditions and enabled when abnormal temperature readings are detected.

Trigger Terminal

The Input signal icons (Thermocouple, VDC, GPDI, etc) are all equipped with an Trigger Terminal. The Trigger only responds to a Pulse, not the Signal State. Upon transition from LOW to HIGH, a Trigger Pulse causes an enabled icon to process (e.g. take a sample, execute an equation, update its Output, etc).

Select Terminal

The special functions of the Select Terminal are described in Appendix A with the two icons that have one (Mux and Conditional LCD Message).

Update Output Terminal

The Sample Rate Clock and the Warm-up icon have a special Output terminal located at the bottom center of the graphic called an Update Output Terminal. This Terminal sends a command to the connected icon to process (e.g. take a sample, execute an equation, update its Output, etc). Details on the Sample Rate Clock and the Warm-up icon are covered in the Program Net Palette Icon Reference in Appendix A.

TO DEVELOP A NEW PROGRAM NET…

To develop a new Program Net, first configure the hardware. Then configure Hardware and Palette icons and connect them to form a net. Icons are the main building blocks used in the development of a Program Net. Icons within a Program Net graphically represent different items, ranging from hardware Input channels to intermediate processing functions to hardware Outputs and more. See Appendix A (Program Net Palette Icon Reference) for details on the available processing icons and Appendix B (System Base Icon Reference) or Appendix D (ILIM-7 Module Icon Reference) for information on hardware icons. Details on Configuration, applications, and proper usage are described there.

CONFIGURING THE HARDWARE

Before starting a net, configure the Logger hardware as required for the data logging application. This includes installing modules, and setting channel configuration switches. For more information refer to the Chapters on Logger System Base and Interface Modules.

CONNECT HYPERWARE-II TO THE LOGGER

The target Logger's hardware configuration must be known before you begin. Open HyperWare-II and establish a connection to the Logger from the Communication Window. Refer to the Chapter 5 (Communications) for more details on how to connect to the Logger.

POLL THE HARDWARE CONFIGURATION

Switch to the Net Programming Window and click on the Poll for Hardware (a.k.a. New) button. The connected Logger will be automatically polled for its hardware configuration.

The workspace will be updated to show icons representing the standard System Base hardware and all icons representing Channels of User-installed modules.

> **Tip:** Save this raw Hardware Configuration as a Program Net file for later use if desired.

Before any editing begins, this unconnected Program Net should be saved to disk by clicking on the File Save button or using the `File - Save Net As' selection from the menubar and specifying a suitable name. This unconnected Program Net can then be used as a starting Net for development of varying Program Nets based on the same Logger configuration.

ADD ICONS FROM THE NET PROGRAMMING PALETTE

A floating Icon Palette displays on the Programming Window workspace. This expands to show a collection of Palette icons when hovering the mouse over it. These icons can be added to the workspace then interconnected with other hardware Input/Output icons to build a Program Net.

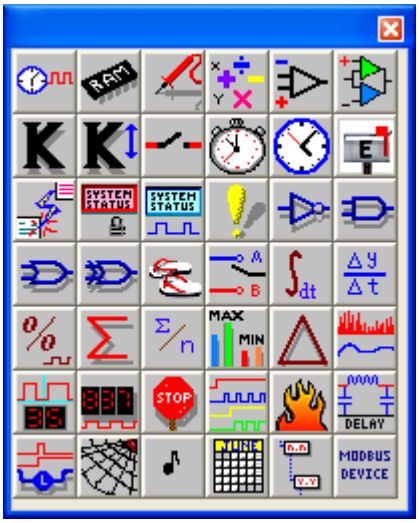


Figure 8-5; Program Net Icon Palette

Hover the mouse over the palette to expand it. Drag an icon from the palette and drop it onto the workspace. To do this, click on the desired icon and while holding the mouse button down, drag the icon onto the workspace. Release the button when the icon is positioned in the approximate desired location. Alternatively, double clicking on a palette icon will copy it to a pre-determined location on the workspace.

The same Drag & Drop technique can relocate icons within the workspace - even after connections have been made. The Program Net workspace utilizes dynamic scrolling. As an icon is dragged near the edge of the screen, the workspace will scroll.

SELECT AND CONNECT ICONS

Lines are used within a Program Net to indicate the flow of signals between icons.

Selecting Icons on the Workspace

Icons that are selected can be moved or deleted. Click once on an icon to select, or put focus onto it (shown by a blue highlighted band). To select multiple icons, hold down the *SHIFT* key and click on each of them. A second click on any one of your selected icons (while still holding down the *SHIFT* key) will deselect only that icon. To simultaneously select a set of icons, click on an empty area of the workspace and drag to create a selection box. Use a selection box to surround or touch the set of icons you want.

Removing Icons from the Workspace

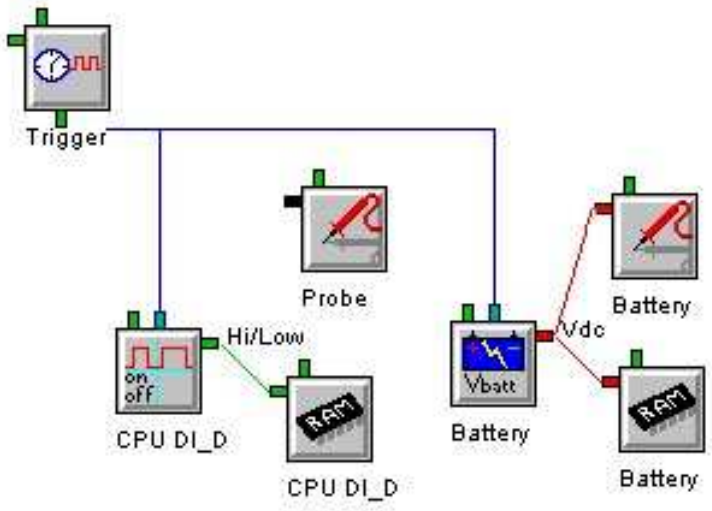
Click once on the icon to select, or put focus onto it (shown by a blue highlighted band) then press the keyboard *Delete* or *Back Space* key. Hardware icons cannot be removed. When a palette icon is removed, all connections to it are also removed.

Using the Mouse

To connect two icons, locate the mouse cursor over an appropriate Terminal from the first icon (note how the cursor changes when properly located over a Terminal). Click and hold the mouse button down, then drag a connecting line over to the desired Terminal of the other icon. For ease, if the second icon only has one Terminal of that type (i.e. Input), releasing the cursor anywhere on the body of that icon will automatically complete the connection.

Color Coding

Red (analog) Terminals connect with red lines, and Green (logic) Terminals connect with green lines, unless a Trigger Terminal is involved. Any Logic Output can connect to a Trigger Terminal, but the line will be Blue and squared off, as a reminder that it is an edge-triggered connection, not steady state. Black Terminals can be attached to either Analog or Logic, and will change color to match the signal type as they are connected.



ANALOG (RED)
Numerical values are transmitted from icon to icon via Analog type signal connections.

Signals communicated via ANALOG type connections	Example icons with ANALOG type terminals
Temperature	Outputs from thermocouple icons
Voltage	Outputs from voltage icons
Pressure	Math (inputs and outputs)
Flow	Inputs to comparators

LOGIC (GREEN)
High / Low values are transmitted from icon to icon via Logic type signal connections. A Trigger Pulse is a special type of signal. Whenever a Logic Output is connected to the Trigger Input of an icon, every rising edge of the signal causes the icon to process.

Signals communicated via LOGIC type connections	Example icons with LOGIC type terminals
High or Low conditions	Inputs to relay alarm icons
	Outputs from comparators
	Enable terminal inputs
	Input to message icon
	Output from start/stop clock
	Inputs to counters
The TRIGGER Pulse generated by the SRC icon	Input icons have a TRIGGER input terminal

Valid Connections

During the connection process or before attempting to upload a Program Net to a Logger, the Program Net checks and disallows recognized illegal connections such as:

An Analog Terminal cannot be connected to a Logic Terminal.

Each Input Terminal can only have one single connection.

Output Terminals can only connect to Input or Control Terminals.

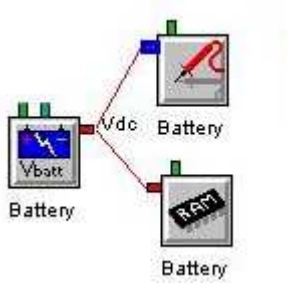
Connections cannot be made between Terminals on the same icon.

Multiple Inputs

During the construction of Program Nets, it is common for multiple connection lines to originate from an Output Terminal, however most icons can only have one or two Inputs. Some icons (such as Email or Logical AND) allow for more than two Inputs and will automatically add Input Terminals as connection lines are added.

Disconnecting Icons

To undo a connection between icons, select the Terminal from either end of the connection line by clicking on it once to put a blue band around it. Then press the keyboard *Delete* or *Backspace* key.



Global Icon

One special icon that is included in every Program Net is called the Global icon. Within the Global icon's Configuration dialog are options for various global Program Net options. These options include the Program Net Name, memory utilization mode, and modem parameters. The operation of this icon should be reviewed in the System Base Icon Reference in Appendix B before attempting to construct a Program Net.

CONFIGURING ICONS

Most of the icons within HyperWare-II must be configured before they can be used. User configuration entails selection of various icon operational parameters such as names, Input ranges, sampling rates, etc. and is simply done through dialog boxes associated with each icon.

To configure an icon that has been placed on the workspace, double-click on the icon body and an icon Configuration Dialog box will appear. Various standard Windows techniques are used to select the different parameters within the dialog box, from text entry and editing to selection via radio buttons.

Each icon has unique properties and programmable parameters to meet its needs. However, many properties are common to the different types of icons. The Dialog shown in Figure 8-6 illustrates the most common properties. A description of properties typically seen in a configuration dialog box follows.

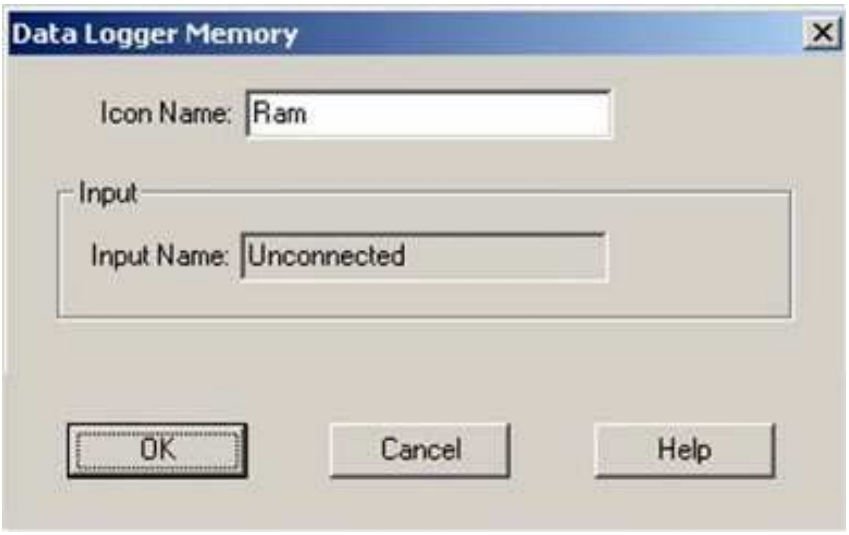


Figure 8-6; Icon Configuration Dialog Box

Icon Name

At the top of each icon Dialog will be a text box for entering the Name of the icon. This name will be displayed beneath the icon on the Net Programming Window. It is also the name that will be used for that icon in Output Data, Quick Probes displays, on the LCD display and in Real-Time Trending. The Icon Name is limited to 20 characters.

Input Name(s)

The Configuration Dialog will also display the names of anything connected to this icon's data Inputs. If nothing has been connected, this will be displayed as "Unconnected." Each icon's name can only be modified from its own Configuration Dialog.

Units

Some icons can assign various units such as Degrees C or F, etc. to their output values. Radio buttons are typically used to select one of the Unit types. Some icons, which perform calculations on the input signals, provide an edit box for the User to specify what the resulting Units will be. All others simply use the same Units for Output as they receive on their Inputs.

Input Range or Signal Type

A Thermocouple type icon can support 6 different types of thermocouple. A CPU Current Input type icon can have its range set to any one of eight settings, starting at *–100 to +200uA* and going as far as *–12 to + 20mA*. Similarly, other Input icons have User-configurable ranges or types.

Other Parameters

Most of the icons have additional parameters such as filtering, equations, data types, message text, etc. that are all User-programmable. See Appendix A (Program Net Palette Icon Reference) and Appendix B (System Base Icon Reference) or Appendix D (ILIM-7 Module Icon Reference) for details on specific icons. See Chapter 9 (Custom Web Pages) for detail on the Web icon.

SAVING THE NET

After development of the Program Net, the program can be saved to a file by using the *File - Save Net As* selection from the menubar. Any Web Pages and their images will be automatically saved in a subdirectory of the net itself, named after the Program Net.

REVIEW NET PERFORMANCE

After construction of a Program Net a quick review should be done to insure that the Net's performance in the Logger will meet the User's goal. This check should include proper implementation and for higher speed applications, a processing (execution) speed review.

Program Net Checklist

Has the Global Icon been configured? Have a Program Name and Description been assigned?

Have connections been added between icons?

Have desired measurement units (e.g. C, F, ohms, etc) been selected?

Does each icon have a meaningful name? Names are not necessary for the icons to function, however, if they are used consistently during the construction of a Program Net, the presence of a User-defined name (vs. the default name) becomes an indicator that the icon has been configured. Additionally, the added annotation makes comprehension of the net by other Users and/or at a later date even easier. Probe Point and Memory icons are especially important for identifying data during Real-Time Trending and Post-processing.

Program Net Execution Speed

Users utilizing the Logger for data collection at slower rates (e.g. Samples per Minute) may opt to skip this section and refer to it later when faster rates are required.

> **NOTE:** The information presented in this section is provided for Users that are attempting to collect data at sub-second sample rates.

Due to the nearly unlimited flexibility and potential variations of Program Net designs, it is difficult to specify the actual speed performance of Program Nets. In an attempt to relate to the Logger User a feel for the Program Net processing speeds to be expected, the following guidelines are presented.

Program Net Performance Guidelines

The time required for a Program Net to execute within the Logger is a function of a number of variables including:

TOTAL NUMBER OF ICONS IN THE PROGRAM NET
With a greater number of icons to process each time the Program Net loops, more time is required.

TYPE OF ICONS
Different types of icons require various amounts of time to process. For example, a Thermocouple Input icon requires a considerable amount of processing time to perform the analog to digital conversions, CJC measurements, and the associated

math. On the other end of the speed spectrum, a Data Memory icon merely stores data into a memory location - an operation that can be performed very quickly.

PROGRAM NET DESIGN

Program Nets can be developed that have varying execution times that are a function of Inputs or values within the Net. A simple example of this is a Program Net that scans a single digital Input (e.g. switch state) and only enables the logging of 10 thermocouple Input channels when the switch is closed. In this example, the digital Input could be scanned very fast when open, but when it closes, extra processing time is required for the 10 thermocouple channels.

An Empirical Answer...

After optimization of a Program Net with consideration of the above guidelines, the best way to determine the speed performance of a Net is to upload it to a Logger and run it. If maximum speed is the goal, the driving Sample Rate Clock rate can be set to a minimum (e.g. 5mS) and the program can be tested. Review of the data and actual sample times will result in a very accurate execution rate value.

Following are three benchmark Program Net execution times that can be used to gain a relative feel for the sampling rates achievable with the Logger. The times were empirically determined with a single channel (as specified) storing directly to memory. In each case, the Program Net consists of one Sample Rate Clock icon, one Input channel icon, and one memory icon. No filtering was enabled.

Input Icon Type	Samples per Second (one channel)
Vdc-LO	150
Thermocouple Type J	30
Counter (GPDI)	320

Table 8-1; Program Net Approximate Throughput Rates

Nets that utilize conditional logging strategies will have varying execution rates. A feel for these Net execution rates can be developed by constructing and running Program Nets that represent each conditional branch of the Net, then summing the execution times for branches that can could execute simultaneously.

Miscellaneous Program Net Performance Considerations

MISSED SAMPLES

Although it is possible to set Sample Rate Clock rates faster than a Program Net can actually execute, the Program Nets will attempt to run. In these conditions, if a Sample Rate Clock sends the Trigger Pulse before the Net has been fully executed, the Logger will finish the Net execution then immediately start processing the Net again.

The fact that a Trigger Pulse has been processed late is accessible to the User via the Warning icon. One of the options within the Warning icon is to provide a logic Output if a Sample is Missed. Details on the Warning icon are provided in the Program Net Palette Icon Reference in Appendix A.

It must be noted that in this situation, although the actual data has not been sampled at the programmed rate, all collected data will include the actual date/time that the Net executed.

> **Tip**: To achieve maximum speed of a Program Net, the Sample Rate Clock (s) used in the Net can be set to a rate faster than the Net can possibly process.

OTHER DETRIMENTS TO SPEED

Any additional processing that is performed during execution of a Program Net such as communication (e.g. Real-Time Trending, Quick Probes, Status Queries, Data Download, etc.) and/or display of readings through the Logger front panel LCD will have detrimental effects on the rate at which a Program Net can execute. For optimum speed the LCD should not be displaying updating information.

PROGRAM NET TO UPLOAD TO THE LOGGER

After the Program Net has been checked and saved, clicking on the toolbar Communication Window button will return HyperWare-II to the Communication Window. The Program Net icon displayed on the PC graphic represents the most recently edited Program Net. Drag and drop the Program Net icon from the PC to the connected Logger to upload the new Program Net. Refer to Chapter 6 (Communication Window) for details of the uploading procedure.

VIEW OPTIONS

There are two options under the menubar command *View*.

PAPER COLOR

Changing the Paper Color changes the background color of the Net Programming Window.

STATUS BAR

When this option is checked, a status bar appears along the bottom of all HyperWare-II Windows, where helpful information appears. For example, if the cursor floats over the Probe icon on the Logger image on the Communication Window, the ToolTip simply displays “Quick Probes” but the status bar explains, “A diagnostic view of the current Probe Point values.” If this option is not checked, the status bar and its information will remain hidden.

PROGRAM NET DOCUMENTATION

A feature is provided within the Program Net Window to assist in documenting and the ensuing field wiring of the Logger.

EDGE CONNECTOR WIRING PRINTOUT

An Edge Connector I/O Listing can be generated and printed for the Program Net. This listing can then be used during the field wiring of the various I/O signals to the Edge Connector.

Upon completion of the Program Net, select *View Wiring/Connection List* from the File menu, to display the wiring printout in a separate popup window after the file containing the wiring information is generated. The listing can then be printed and carried with the Logger to the installation site if needed.

The Edge Connector Listing includes connection details for each of the I/O channels that is used in the Program Net as well as standard connections for External Power, the Digital Address and the CJC connector. Names assigned to Input and Output icons in the Program Net are used for channel identification.

9 MODBUS INTERFACE WITH THE INTELLILOGGER

The IntelliLogger can be provided with Modbus communication capability. Currently, the following Modbus Modes are available as options for the IntelliLogger:

- Modbus RTU Master - the IntelliLogger can interrogate connected 'Slave' devices via RS-232 or RS-485 connections.
- Modbus RTU Slave - the IntelliLogger's Modbus registers can be interrogated by connected Modbus 'Master' devices via RS-232 or RS-485.
- Modbus TCP Server - the IntelliLogger's Modbus registers can be interrogated by connected Modbus 'Client' devices via the Ethernet port.

MODBUS RTU MASTER MODE

Connected Slave device registers can be added to Program Nets using the Modbus Slave icon. Once configured from within HyperWare-II, they can be utilized within a Program Net much like any other hardwired (e.g. thermocouple) input. Register values can be periodically sampled, processed (e.g. averaged, totaled, scaled, etc), and then stored to memory and/or used for alarms, integrated into emails, Web pages, FTP reports, etc. The IntelliLogger can also write information to connected Slave device registers in order to change device settings, alarm states, constants, etc.

EXAMPLE PROGRAM NET IN RTU MASTER MODE

This is an example Net program that monitors the temperature and energy consumption of a large space heater. The part making use of the IntelliLogger as a Modbus RTU Master is the lower branch.

Energy consumption is monitored by reading a value from a power sensing harness that communicates using the Modbus protocol. The readings are converted to understandable units of kilowatt-hours (kWh) and stored to the IntelliLogger's internal memory using the Memory icon.

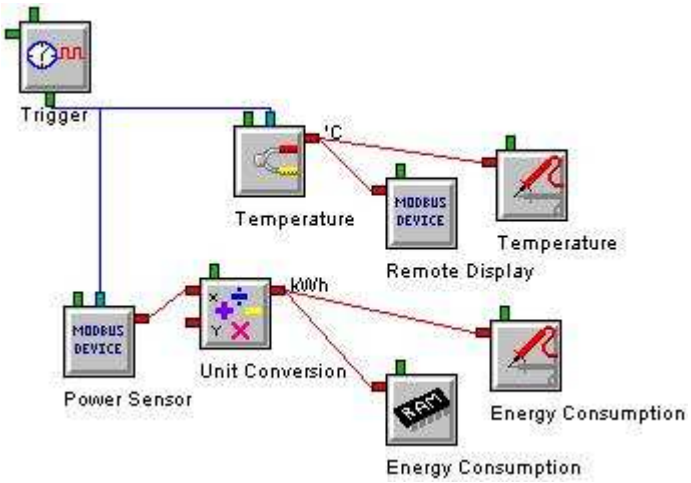


Figure 9-1; Example Program Net in RTU Master Mode

SEQUENCE OF STEPS TO USE THE MODBUS RTU MASTER MODE

Here is an overview to assist in the setup and use of the Modbus RTU Master mode.

Review Slave device manual for available registers and formats

The best place to find information on what data is accessible is in the slave device's manual. Typically there are a number of tables listing the available data, what registers it is stored in, what format it is in (e.g. integer, floating point, or bitfield), and the register order.

Connect Modbus Network and Configure the IntelliLogger

Refer to Modbus Network Connectivity below.

To configure the Modbus settings, refer to Communication Window – System Configuration – Modbus Tab.

> **Warning:** The *RS-232 PC Port* will not work unless you check the box labeled "Enable Optional Use" in the *Logger Configuration – Modbus* tab.

Add icon

In the Program Development Window, add a Modbus Slave icon for each desired parameter to the current net either from the Icon Palette or from the Modbus menu at the top of the window.

Configure icons

Each icon will read or write a single parameter to a single slave device and must be configured to do so using the information previously retrieved from the slave device manual. Refer to **Modbus Slave / Server** Device Icon.

Test icons

After entering all of the settings, always test the configuration by clicking the test button. If no value is read from or written to the slave device then there is a mistake in how the device was connected (refer to SCC-1 Wiring below), the slave device has lost power or malfunctioned, or the icon has been configured incorrectly. For troubleshooting tips refer to below or click the Help button in the test window to bring up a troubleshooting topic.

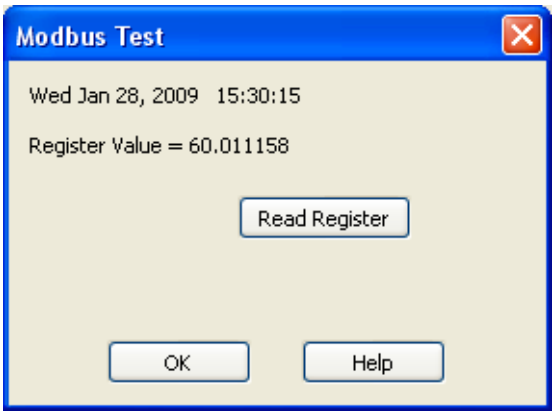


Figure 9-2; Modbus Test Dialog

Optionally save to disk

Once an icon has been correctly configured and tested, it can be saved to disk for later use. This way an icon never has to reconfigured for that particular slave device parameter. Modbus icon configurations are saved with the .mbi file extension and can be

added to a net by clicking “Add Saved Icons” under the Modbus menu in the Program Development Window.

Build into Program Net

READ VARIANT
The icon’s trigger will need to be connected to a Sample Rate Clock or some other icon that periodically tell it to take a reading. When the trigger occurs, the IntelliLogger sends out a request for data and upon receiving that data, outputs it as an analog reading to whatever icon is connected to its output terminal (e.g. Math, Probe Point, or Memory icons).

WRITE VARIANT
The icon’s input must be connected to another icon’s output so that it has some data to send. Whenever the connected icon outputs data, the Modbus icon will write that data to a register in a slave device.

For more information on the Modbus Slave icon refer to **Modbus Slave / Server** Device Icon.

Deploy

The user should verify that the device is communicating reliably by either monitoring the readings using Probe Point icons and/or analyzing the data periodically. If readings are intermittent, the Response Timeout or the Inter-Message Delay Multiplier may need to be adjusted (refer to Communication Window – System Configuration – Modbus Tab).

Troubleshooting Modbus Connection

Communication with a connected Modbus Slave device can fail when using the Test Button in the Test dialog for a number of reasons. Following is a quick checklist encompassing common problems:

- Make sure the “Enable Optional Use” box is checked in the Logger Configuration - Communication Tab if you are using the SCC-1 (Serial Comm Converter, required when using the RS-485 communication protocol in a multi-dropped Modbus network.).
- Make sure that Modbus capability is enabled in your IntelliLogger. If any type of Modbus capability has been enabled you will be able to see the Modbus tab in the Logger Configuration dialog. In the Modbus tab you will only be able to select the types of Modbus communication that have been enabled at Logic Beach and types that have not been enabled will be gray.
- Make sure that the IntelliLogger's PCA revision level is "I" or any other letter that comes after it in the alphabet. You can find out the PCA revision level by looking at the serial number on the outside of the IntelliLogger. The last letter in the serial number represents the PCA revision level. If the PCA revision level is a letter that comes before “I” in the alphabet or if there are no letters at the end of the serial number then you will need to return your IntelliLogger to Logic Beach to have it upgraded by our technicians.
- Make sure the correct type of Modbus communication is selected, RTU Master, RTU Slave, or TCP Server in the Logger Configuration – Modbus tab.
- Ensure that all wires in your Modbus network are securely connected and that the SCC-1 is plugged into the IntelliLogger's "RS-232 PC" port.
- The RS-485 connections at the TX+/TX- or B/A terminals might be backwards so try switching them. No damage should occur from an incorrect connection at the terminals, it will simply fail to communicate.
- Ensure that the Modbus Slave device you are attempting to communicate with is turned on and properly configured. Refer to the individual Slave device's manual for help with this.

- Ensure that the IntelliLogger has been configured in the Logger Configuration - Modbus tab with the correct Baud Rate, Parity, and Stop Bit settings. These settings must match those specified for the Modbus Slave device with which you are attempting to communicate. Refer to the individual Slave device's manual for help.
- Ensure that the Modbus Slave icon has been configured with the correct Device Address, Register Starting Address, Read/Write mode, Register Numeric Format, Register Order, and Integer Register Sign settings. Refer to the individual Slave device's manual for help.
- Ensure that the Register Starting Address contains five digits. Some manuals may specify a short address like "23" and call it a "Holding Register". Holding registers are in the range of 40,000 to 49,999. This means that the actual address you should enter is "40023".
- Make sure the Logger Modbus Address is not the same as the Modbus Slave Device Address. Refer to the Slave device manual for help in setting the network address. The IntelliLogger's network address is specified in the Logger Modbus Address setting in the Logger Configuration – Modbus tab.
- If Modbus communication is intermittent or non-existent you may need to increase the Inter-Message Delay Multiplier in the Logger Configuration - Modbus tab. Some Slave devices are unable to communicate as fast as is specified by the Modbus standards. By increasing the delay time between messages being sent to the device, additional time is allowed for slower Slave devices to process messages and respond.
- If Modbus communication is intermittent or non-existent and long RS-485 wiring runs are used, there may be problems with reflected signals. Ensure that terminating resistors are used. Refer to the chapter titled "Modbus Interface with the IntelliLogger" in the IntelliLogger manual for more information.

MODBUS RTU SLAVE MODE

With the IntelliLogger configured as a Modbus Slave/Server device, outside Master/Client devices can interrogate the IntelliLogger's Modbus registers and use them for their own applications.

Configuration of the Registers is done from within the HyperWare-II icon-based programming environment. Register addresses are assigned to each of the icons within the Program Net for which register value sharing with a connected Modbus Master device is desired. IntelliLogger Modbus Registers can be configured to allow a Master device to access the following IntelliLogger parameters:

Current Value Readings

Current values, whether they be analog input signals, calculated values, event states or any other I/O parameter can be read from the IntelliLogger. Modbus access is implemented by the addition of Probe Point icons into the IntelliLogger Program Net and then assignment of a Modbus register number to the Probe Point.

Remote Control Icon State Update

Remote control (On/Off) icon states within the IntelliLogger Program Net can be updated by writing to IntelliLogger Modbus Registers. This facilitates remote On/Off control of actions within the IntelliLogger from a remote instrument over the Modbus link. These On/Off actions can change the operation of the IntelliLogger program while it is running as well as control physical outputs on the IntelliLogger.

Remote constant Update

Upon command from a Modbus Master device, the Remote Constant icon within an IntelliLogger Program Net can be updated. This allows a remote Modbus Master device to change set-points, alarms, constants used in calculations, etc via the Modbus link.

EXAMPLE PROGRAM NET IN RTU SLAVE MODE

This is a net that takes periodic readings from a pressure sensor connected one of the IntelliLogger's mA inputs and stores readings to memory when the pressure is above a threshold value represented by the remote constant icon.

Inside the Modbus Register List icon the pressure sensor and compare probes have been given register addresses so that they can be read by a connected master RTU device and the remote constant has been given a register address so it can be changed by the master RTU device if desired.

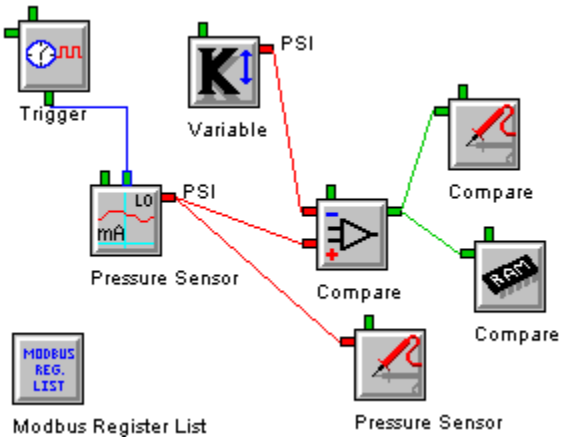


Figure 9-3; Example Program Net in RTU Slave Mode

SEQUENCE OF STEPS TO USE THE MODBUS RTU SLAVE MODE

Here is an overview to assist in the setup and use of the Modbus RTU Slave mode.

Connect Modbus Network and Configure the IntelliLogger

Refer to Modbus Network Connectivity below.

To configure the Modbus settings, refer to Communication Window – System Configuration – Modbus Tab.

Build Program Net

In the Program Development Window, build a net that has at least one Modbus addressable icon, see above for details on which icons have this capability.

Configure Modbus Register List icon

Set a unique register address for each icon shown in the Modbus Register List dialog. Refer to **Modbus Register List Icon** and Dedicated Use Status Addresses below.

Deploy

The user should verify that the device is communicating reliably by either monitoring the readings taken by the master device or verifying that icons in the net are being updated. If things aren't working smoothly, the Response Timeout or the Inter-Message Delay Multiplier may need to be adjusted (refer to Communication Window – System Configuration – Modbus Tab).

DEDICATED USE STATUS ADDRESSES

A set of IntelliLogger Status parameters have been permanently assigned to a range of addresses. These addresses are in addition to (and not listed within) the Modbus Register

List icon. As above, these Registers can be accessed from a connected Modbus Master/Client device.

The Dedicated Status Registers follow:

Starting Address	Field
9001	Logger Name (Character String)
9012	Unit Name (Character String)
9023	Software Version (4 byte value)
9025	System Status Flags (32 single-bit flags)
9027	Logger Time (32-bit integer seconds)
9029	Logging Start Time (32-bit integer seconds)
9031	Program Net Name (Character String)
9042	Program Net Description (Character String)
9053	Log Memory Size (32-bit integer)
9055	Log Memory Used (32-bit integer)
9057	Net Memory Size (32-bit integer)
9059	Supply Voltage (floating-point volts)

CONSIDERATIONS IN USE:

The logger uses the Modbus convention of addressing the first available register as register one. Some debugging tools or applications are known to address the first available address as address zero. As a result, if the logger is used with one of these tools, the tool will incorrectly access members of the status block and/or probe point values.

Typically, this situation may be resolved by using an address one less than the address expected. For example, try using address 9058 instead of address 9059 to read the logger supply voltage in such cases.

Note: Some that third-party tools may reverse the order of the two adjacent 16-bit registers used to form a 32-bit element used by the logger. This situation may be resolved by checking the "Swapped Data Register Order" check-box on the Logger Configuration - Modbus Tab.

MODBUS TCP SERVER MODE

This option functions identically to the Modbus RTU Slave option (refer to Modbus RTU Slave Mode above) with the exception that communications are all performed over Ethernet using the Ethernet port of the IntelliLogger.

Rather than Master and Slave terminology, communicating devices on a Modbus TCP/IP network are referred to as Server and Client. The IntelliLogger Modbus TCP option supports use of the IntelliLogger as a Modbus Server… allowing other network Client devices to garner register values from the IntelliLogger.

SEQUENCE OF STEPS TO USE THE MODBUS TCP SERVER MODE

The only difference in steps between this and Modbus RTU Slave (refer to Sequence of Steps to Use the Modbus RTU Slave Mode above), are how to connect to and configure the IntelliLogger (refer to Modbus Network Connectivity below). To configure the Modbus settings, refer to Communication Window – System Configuration – Modbus Tab.

MODBUS NETWORK CONNECTIVITY

The IntelliLogger supports both Modbus TCP and Modbus RTU connectivity.

MODBUS TCP CONNECTIONS

All Modbus TCP connections to the IntelliLogger are made using its integral Ethernet port and an Ethernet cable.

MODBUS RTU

All Modbus RTU connections to the IntelliLogger are made using its integral DB-9 "RS-232 [PC]" port.

RS-232 links

For RS-232 communication, a DB-9 cable can be used to directly connect a single Modbus device to the IntelliLogger.

RS-485 Links

The Serial Comm Converter (SCC-1) must be used to connect the IntelliLogger's RS-232 port to the RS-485 Modbus network which can consist of up to 247 devices.

OVERVIEW OF RS-485 NETWORK

The RS-485 network that the IntelliLogger connects to can consist of one or more RS-485 multi-dropped Modbus devices. These devices are all connected in parallel along a long twisted pair of wires. The wires are twisted to avoid any noise or distortion of the signal. Ideally these wires would also be protected by a shielding that would be connected to ground.

For cable, Logic Beach recommends using Belden part number 9841 for 2-wire (half-duplex) operation or part number 9842 for 4-wire (full-duplex) operation. These cables are shielded, have 24AWG conductors, 120 ohm impedance, and 300V insulation.

Each device is connected to the twisted pair by very short wires so that the devices seem to be "chained" together.

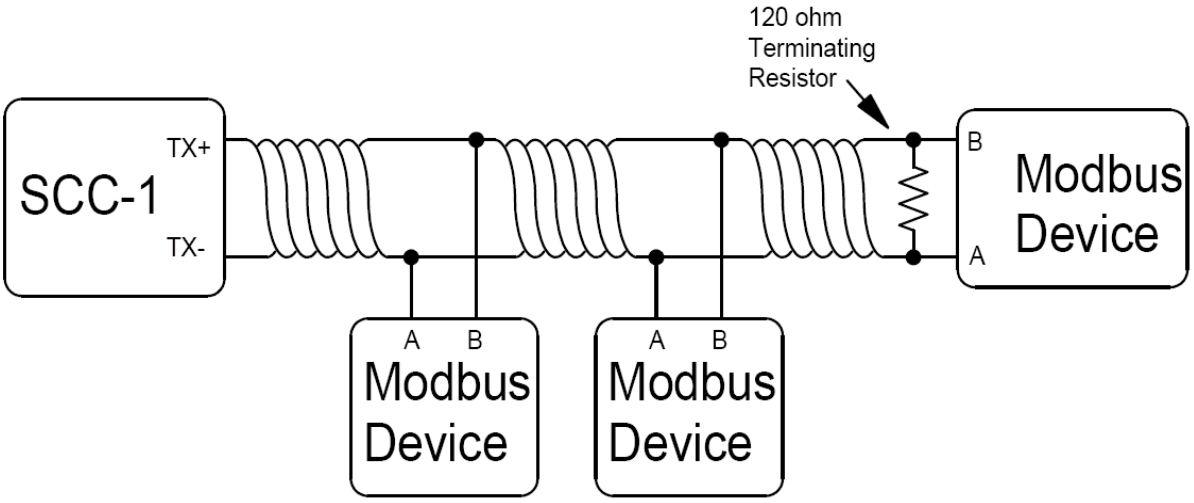


Figure 9-4; RS-485 Multi-Dropped Modbus Network Wiring Diagram

SCC-1

The Serial Comm Converter (SCC-1) converts RS-232 communication from the IntelliLogger to RS-485. It has a DB-9 cable that connects to the IntelliLogger's RS-232 port and a five position terminal strip to connect to the RS-485 network. It is capable of communicating in both 2-wire (half-duplex) and 4-wire (full-duplex) modes.

Figure 9-5; SCC-1

INTELLILOGGER CONNECTION AND CONFIGURATION

The SCC-1 has a DB-9 serial communication cable built into the unit that plugs directly into the IntelliLogger's mating RS-232 "PC" connector. To enable the RS-232 port to communicate with the SCC-1, check the box labeled "Enable Optional Use" in the Logger Configuration - Modbus Tab. If this box is not checked, the IntelliLogger will not be able to use the PC port for Modbus communication.

SCC-1 WIRING

There is a five-position pluggable terminal strip on the SCC-1 for connections to Modbus devices. From one to five, left to right, the terminals are labeled: TX+ TX- RX+ RX- Sh. For two-wire (half-duplex), only *TX+* and *TX-* will be used. For four-wire (full-duplex), the *TX* terminals will be the SCC-1 outputs and the *RX* terminals will be the inputs. *Sh* is the shield terminal and is connected to ground.

A twisted pair of wires should be used for each pair of terminals and if there is any shielding on the wires, it should be connected to the *Sh* terminal to help protect against any noise interference.

The very end of the twisted pair should be connected across a 120 ohm resistor. This "terminating resistor" ensures that signals will not be reflected back down the twisted pair and interfere with communication. Terminating resistors are incorporated into the SCC-1 so they will not be needed at the SCC-1 end of the twisted pair.

Many Modbus device manuals are unclear as to which terminals to connect to other devices so a table has been provided below that lists the connections of some typical terminal names. It is common for manuals to reverse the terminal names but if this happens no damage should occur. The device will simply function incorrectly or not at all and the connections will need to be reversed.

SCC-1 Terminals	Other Common Names

TX+/RX+	D1	B	TD+/RD+	+	Non-Inverting
TX-/RX-	D0	A	TD-/RD-	-	Inverting

Table 9-1; Terminal Connection Names

SCC-1 CONFIGURATION

Configuring the SCC-1 is accomplished by removing or repositioning red jumpers on the circuit board of the SCC-1 (refer to SCC-1 Jumper Access below).

The SCC-1 is configured in two-wire (half-duplex) mode by default but can be changed to four-wire (full-duplex) mode by changing the red jumpers on *J1* and *J2* from the *2W* position to the *4W* position. Make sure that both jumpers are in the same position.

By default there are terminating resistors/capacitors on the input and output terminals to improve communication performance in most cases. These can be disconnected from the circuit by removing the red jumpers *J3* and *J4* labeled *RXD* and *TXD*.

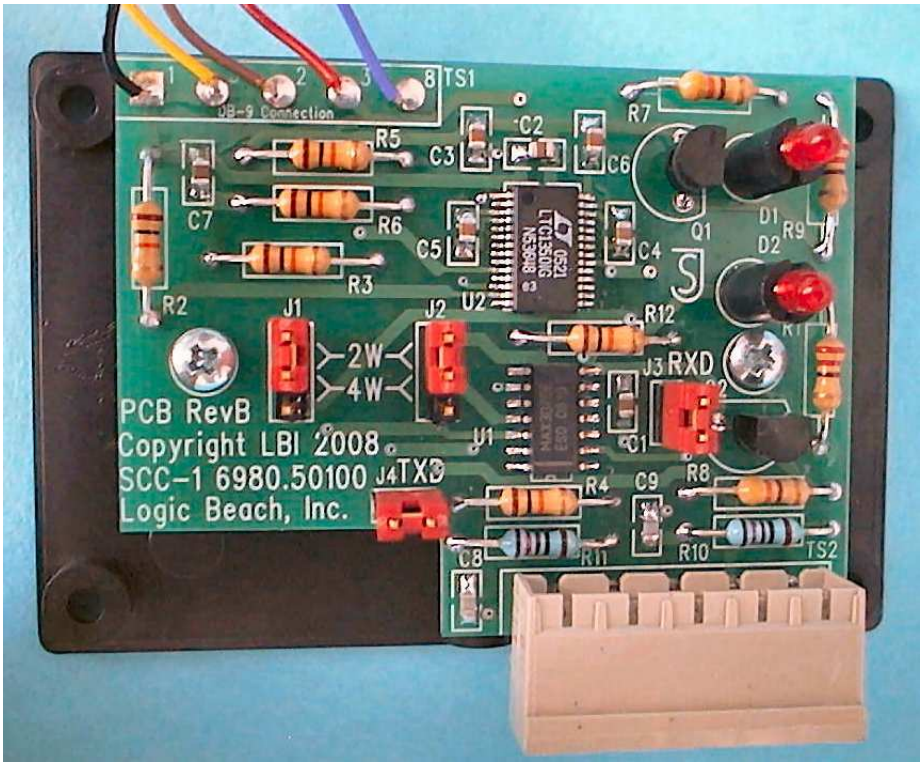


Figure 9-6; SCC-1 Printed Circuit Assembly

SCC-1 JUMPER ACCESS

Begin by first unplugging the DB-9 RS-232 cable from the IntelliLogger and removing the pluggable terminal strip. Unscrew the cap on the black fitting on the *IntelliLogger RS-232 "PC" conn* cable. Be very careful not to pull on the cable now that it is loose as you may damage its connections inside the SCC-1. Remove the four black screws on the back of the enclosure. Carefully pull off the back of the enclosure, allowing the cable to slide through the fitting. You now have access to the circuit board of the SCC-1 so be very careful not to touch anything except for the red jumper.

10 REAL-TIME TRENDING

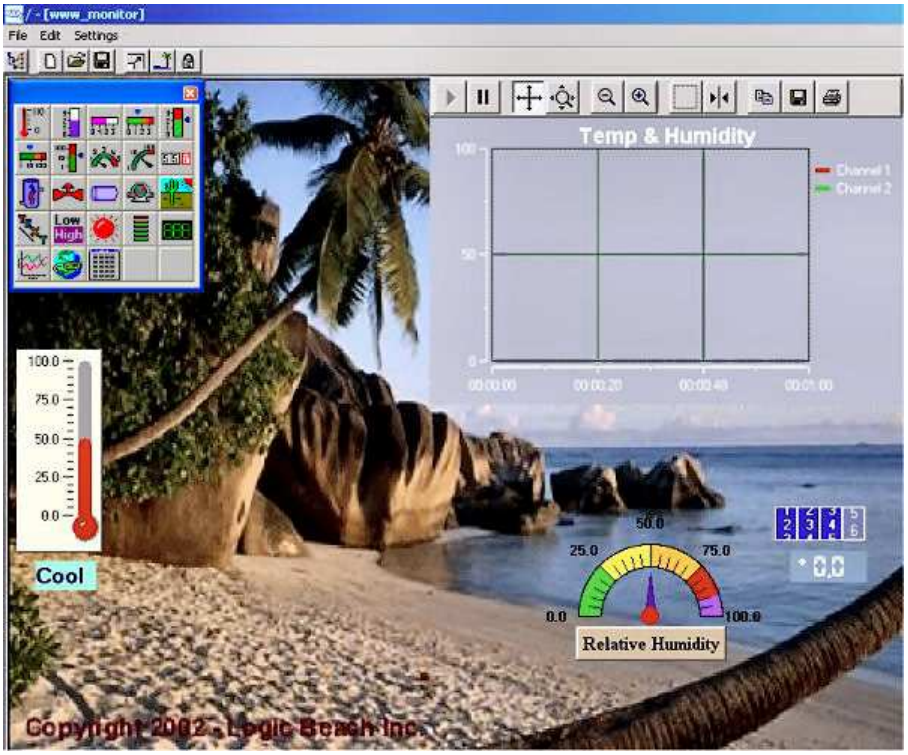
There are two ways to monitor “live” data in the Logger. Both HyperWare-II’s RTT (Real-Time Trending) Window and the stand-alone GreenWater™ application can graphically display the latest Probe Point readings via Custom Web Pages.

REAL-TIME TRENDING WINDOW

From the Communication Window or from the Net Programming Window, use the toolbar icon above or the *Real-Trending* option in the *Window* menu to switch to the Real-Time Trending Window.

DESIGN WINDOW

When designing Web Pages or RTT pages, a Palette is available providing object that may be added to the page, and toolbar icons for selecting a background image or changing the display size. These pages can be saved or opened as a *.xml files, and may be used by both Web page design and/or Real-Time Trending design screens interchangeably.



For more information on designing RTT pages, refer to Custom Web Pages, which describes Custom Web Pages.

VIEWING VIA REAL-TIME TRENDING WINDOW

HyperWare-II provides graphical monitoring of live data in the Real-Time Trending Window, via Probe Points in the Program Net.

> **Note:** Memory icons accumulate data in RAM, but are not used for Real-Time Trending either in HyperWare or the GreenWater™ application. Only Probe Point type icons may be used to monitor live data.

For a plain text display of live values, use the Quick Probes option in the Communication Window instead.

CONSTRUCTION OF THE DISPLAY

Real-Time Trending uses the same type of files as the Web Page icon. Refer to *Designing Web Pages* above for greater detail on how to construct such a file.

Static Probe Point List

Objects placed on the design page can only display data after they have been associated with Probe Points from a Program Net. The Logger may be running one Program Net while the User is editing a different one in the Net Programming Window. The toolbar icon above extracts the Probe Point list from whatever Program Net is currently loaded in the Net Programming Window (if any).

ACTIVATING THE DISPLAY

The Real-Time Trending display is dependent on the data from the running Program Net in the Logger. In the Communication Window, check that the Logger is Enabled. Then in the Real-Time Trending Window, refresh the list of Probe Points in the Logger, and select Run (see below).

Running Probe Point List from Logger

Clicking on the toolbar icon above will poll the attached Logger for a list of all of the Probe Points in its Program Net.

If the icon is disabled, that indicates there is no Logger attached in the Communication Window. If the Logger is connected but has no Program Net loaded, the list will remain empty even after polling.

To check the Probe Point list, open the Configuration Dialog for any data Object from the palette. Ensure that valid Probe Points have been assigned to each data Object. Except for Image and Text Note type objects, each object must be associated with a Probe Point in the Logger in order to display data.

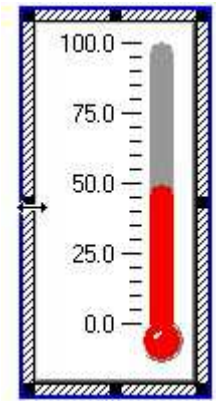
Run/Pause/Stop Buttons

Standard Run, Pause and Stop buttons control the flow of data from the Logger to the objects in the Real-Time Trending Window. When data is Paused, HyperWare-II caches any data received, but does not update the display.

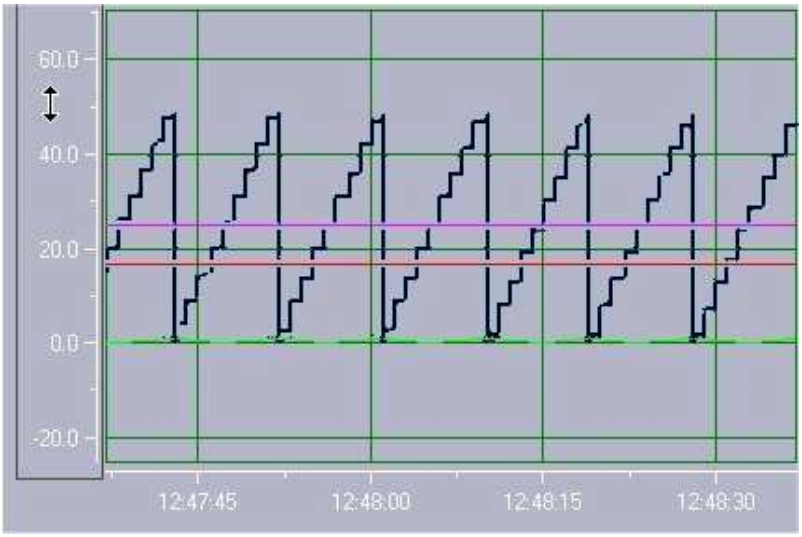
If the Logger is not enabled, no data will be sent from the Logger.

Position Lock

Certain objects have features that involve dragging a part of the object. For example, the plotter can scroll by clicking on an axis and dragging it, or zoom by clicking and dragging a selection box over some of the data. However the default mode is that clicking and dragging anywhere on the body of an object repositions or resizes the entire object.



The plotter scroll and zoom features are not available when the object is in that mode. Clicking on the toolbar icon above toggles the Position Lock feature. When it is active, no Objects can be moved, so the plotter can scroll and zoom.

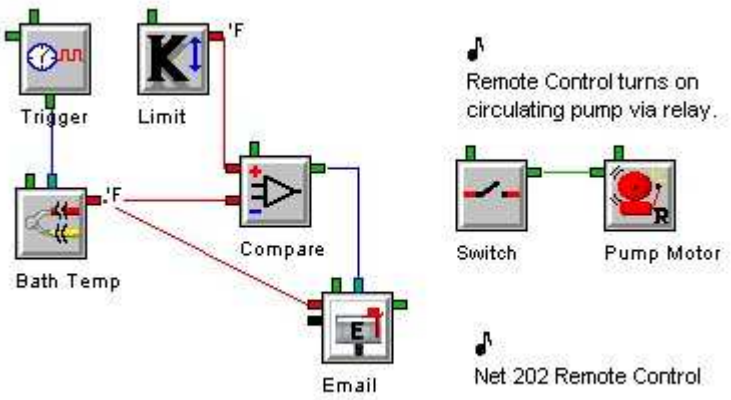


REMOTE CONTROL

Besides monitoring data, the Real-Time Trending Window provides the User with a means of remotely controlling the Logger while it is running. This capability depends upon whether any Remote Control icons (switch, variable) were used in the Program Net.

Example Application Program Net:

The following Program Net monitors the temperature of a plating bath. If the Bath Temp temperature exceeds the value entered in Limit then an Email is sent to the operator.



By accessing the networked data logger from GreenWater or HyperWare-II's RTT Window, the User can remotely turn on the circulation pump to cool the bath, or can adjust the limit as needed.

Accessing Remote Values

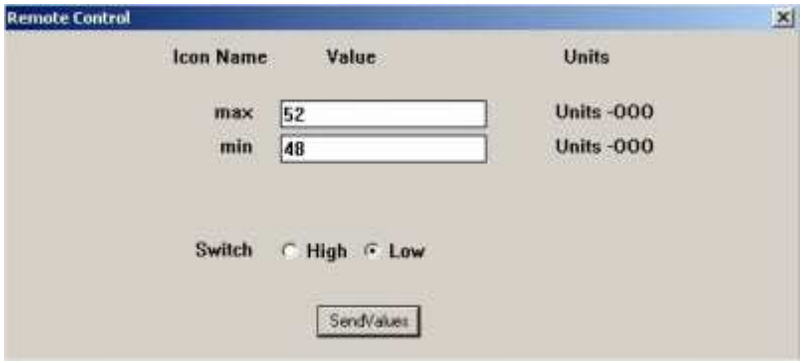
If there are Remote Control icons within the Program Net, they can be accessed from the *Access Remote Icon Values* option in the *Remote Control* menu.

Note: There is no way to revert to prior settings automatically, so it would be wise to record any values before changing them if needed.

Each Remote icon in the Logger's Program Net can be accessed from this Dialog.

REMOTE SWITCHES
(A.k.a. Remote Control icons) are digital, and may therefore only be set to either a High or Low state.

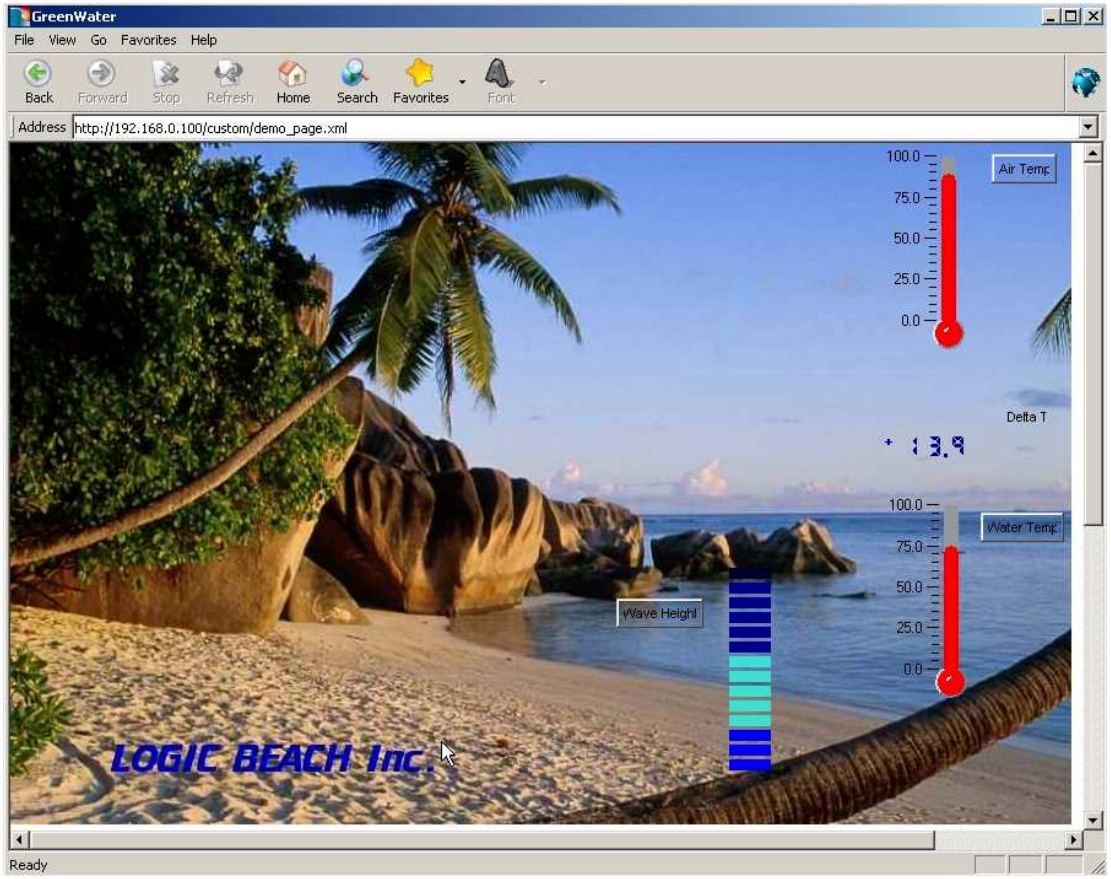
REMOTE CONSTANTS
(A.k.a. Variable icons) have analog values, whose numeric values can be altered as needed.



When all values are set as desired, clicking the *Send Values* button will send the updated values to the logger after a confirmation message is acknowledged. These values will take effect during the Logger's next net scan, which is dependent upon the clock triggers programmed within the Program Net.

VIEWING VIA GREENWATER™

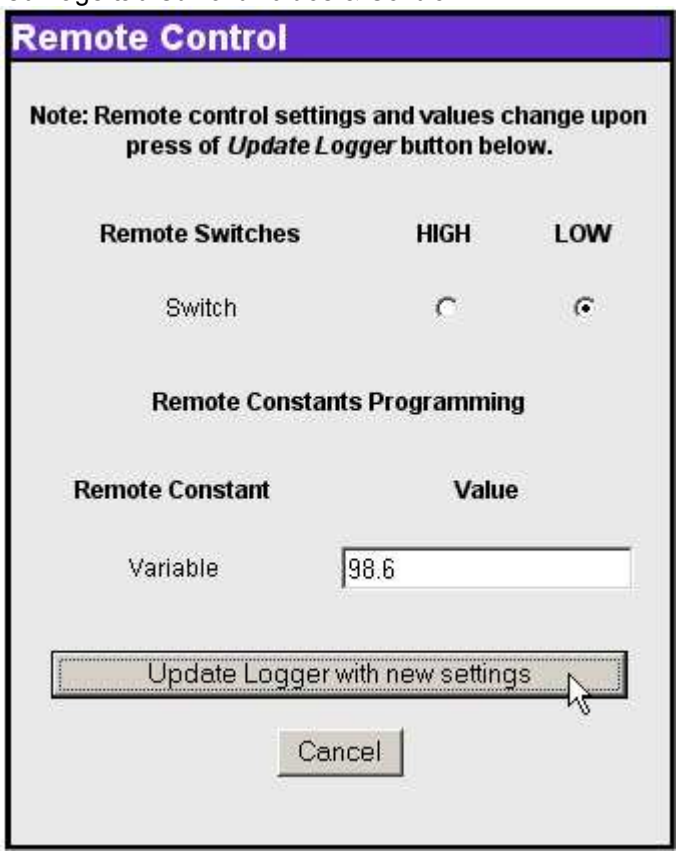
GreenWater™ has the look and feel of a standard web browser, but with the added capability of graphically monitoring live data from Probe Points in Custom Web Pages of the Program Net. The Custom Web Page display is dependent on the data from the running Program Net in the Logger.



To connect to a Logger after starting the GreenWater application, enter the IP address of the Logger into GreenWater's address bar, then press the enter key. This should display the main Status page for the Logger as shown here:

ACCESSING REMOTE VALUES

To modify any Remotely Control icons in the Program Net of the Logger, select the Standard Web Page tab *Current Values & Control.*



Each Remote icon in the Logger's Program Net can be accessed from this Standard web page.

Remote Switches

(A.k.a. Remote Control icons) are digital, and may therefore only be set to either a High or Low state.

Remote Constants

(A.k.a. Variable icons) have analog values, whose numeric values can be altered as needed.

> **Note:** There is no way to revert to prior settings automatically, so it would be wise to record the values before changing them if needed.

When all values are set as desired, clicking the *Send Values* button will send the updated values to the logger after a confirmation message is acknowledged. These values will take effect during the Logger's next net scan, which is dependent upon the clock triggers programmed within the Program Net.

ACCESSING THE DISPLAY

To view Real-Time values via the graphical displays loaded in the Logger, select the *Custom Pages* tab.

Other Browsers

When using a web browser instead of GreenWater, the following message appears when selecting the Custom Pages tab.

Follow the instructions to download a FREE copy of GreenWater.

To view the following IntelliLogger™ Custom Web Pages requires GreenWater™
If you are seeing this page and wish to view Custom Web pages served by the IntelliLogger™ , it is necessary to download and install the Logic Beach GreenWater™ dual purpose browser / viewer. GreenWater provides full browsing capability for Standard and Custom Web pages served by the Logic Beach IntelliLogger™ . Conventional browsers can be used to view the 'standard' Web pages (i.e. Status, Current Values, Data Review, etc) served by the IntelliLogger™, however due to special content within the 'Custom' . pages served by the IntelliLogger™, the enhanced GreenWater™ browser/viewer must be used.
GreenWater™ a powerful Windows application can be downloaded at no charge from http://www.logicbeach.com/greenwater/
The GreenWater™ viewer is a stand-alone Windows based browser client with enhanced capability for viewing IntelliLogger™ custom Web pages as well as standard pages. GreenWater™ is installed using standard Windows application installation methods and is provided with an Uninstall utility.
To download and install GreenWater™ on your PC, follow these steps:
1. Download the GreenWater™ installation program by clicking on the 'Download' button below.
2. When prompted, save the downloaded installation program temporarily to a folder on your disk drive.
3. Launch the GreenWater installation program by clicking on it from within Windows Explorer and the installation begins.
4. Follow the prompts within the Installation process.
Download GreenWater™
GreenWater™ Platform Requirements:
Win95, 98SE, 2000 or XP
10 MB of disk space for install

GreenWater

When using GreenWater, simply click on the Hyperlink corresponding to the Custom Web Page you wish to view.

Address http://192.168.0.100/custom-pages.htm
LOGIC BEACH Inc.
The authority in unrestricted data logging
SERVED BY INTELLILOGGER™
000253
Demonstration Unit
HOME / STATUS
CURRENT VALUES & CONTROL
LOGGED DATA LISTING
CUSTOM PAGES
The following IntelliLogger™ Custom Web Pages are available for viewing with GreenWater™
demo_page_scrolling
demo_page
Click on the above links to view the IntelliLogger™ Custom Web Pages.
Home/Status | Current Values & Control | Logged Data Listing | Custom Pages

For more information on the graphical objects located on Custom Web Pages, please refer to Chapter 9, which describes Custom Web Pages.

11 CUSTOM WEB PAGES

Custom Web Pages are used to monitor live data, via the Real-Time Trending Window of HyperWare, or using the GreenWater™ application.

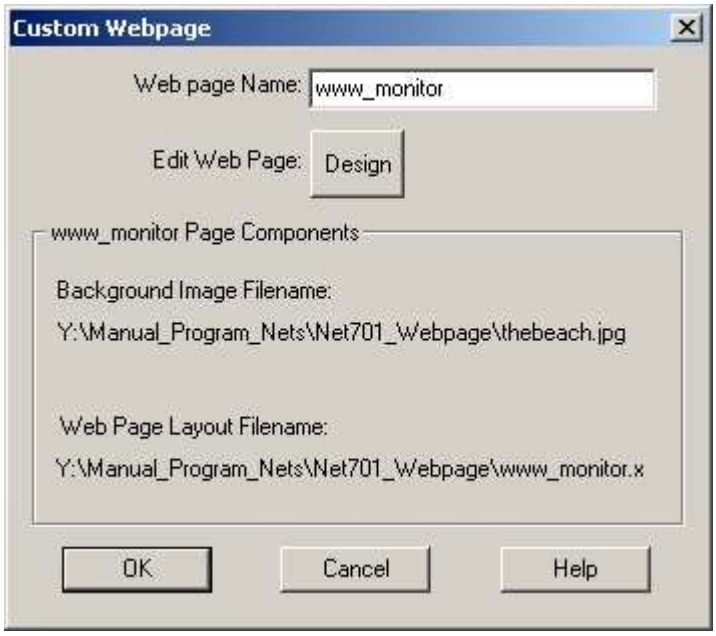
DESIGNING CUSTOM WEB PAGES

Before a Custom Web Page can be designed, a Web icon must be added to a Program Net. Selecting the properties for this Web icon provides access to the *Design* button. Selecting this button switches the display to the Web Design Window.

Files designed and saved in the Real-Time Trending Window are interchangeable with Web Page Design files. Some additional menu commands and toolbar icons are shown in the Real-Time Trending Window, however the Design components are the same for both.

WEB DESIGN WINDOW

A separate Web icon in the Program Net is required for each Custom Web Page. Drag a Web Page icon off of the Net Icon Palette, and then double click it to open the Configuration Dialog.



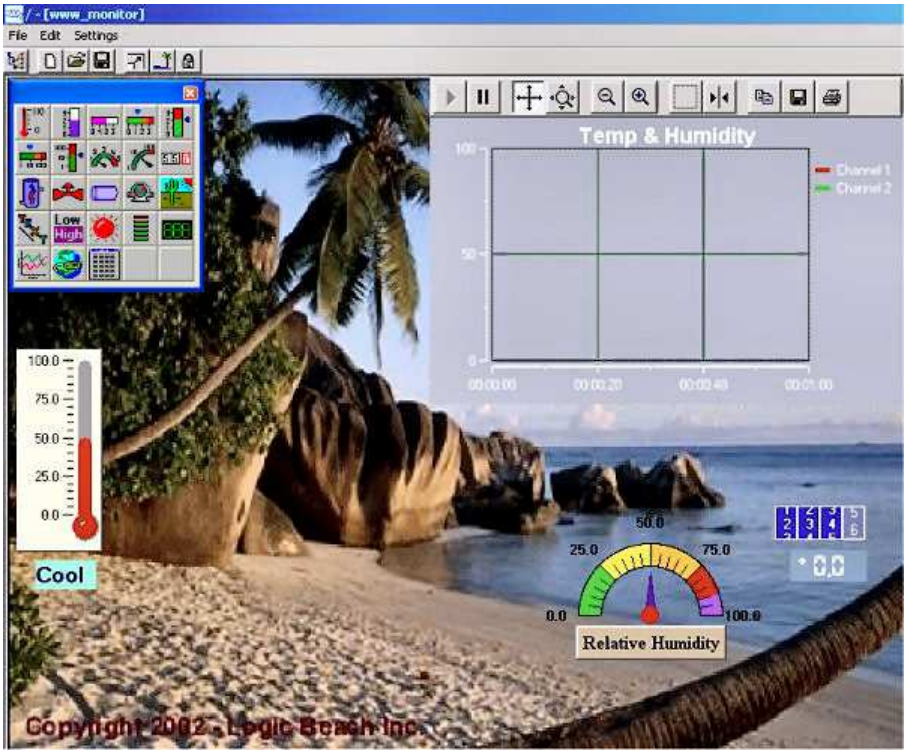
The Icon Name for a Web Page icon will be the name of the Web Page as listed by GreenWater™. Unlike other icons, the Web Page name cannot contain any spaces. The two Filenames shown here are informational only. Click on the *Design* button to select or create a Background or Web Page Layout File.

REAL-TIME TRENDING WINDOW

From the Communication Window or from the Net Programming Window, use the toolbar icon above or the *Real-Trending* option in the *Window* menu to switch to the Real-Time Trending Window.

DESIGN WINDOW

When designing Web Pages or RTT pages, a Palette is available providing object that may be added to the page, and toolbar icons for selecting a background image or changing the display size. These pages can be saved or opened as a *.xml files, and may be used by both Web page design and/or Real-Time Trending design screens interchangeably.

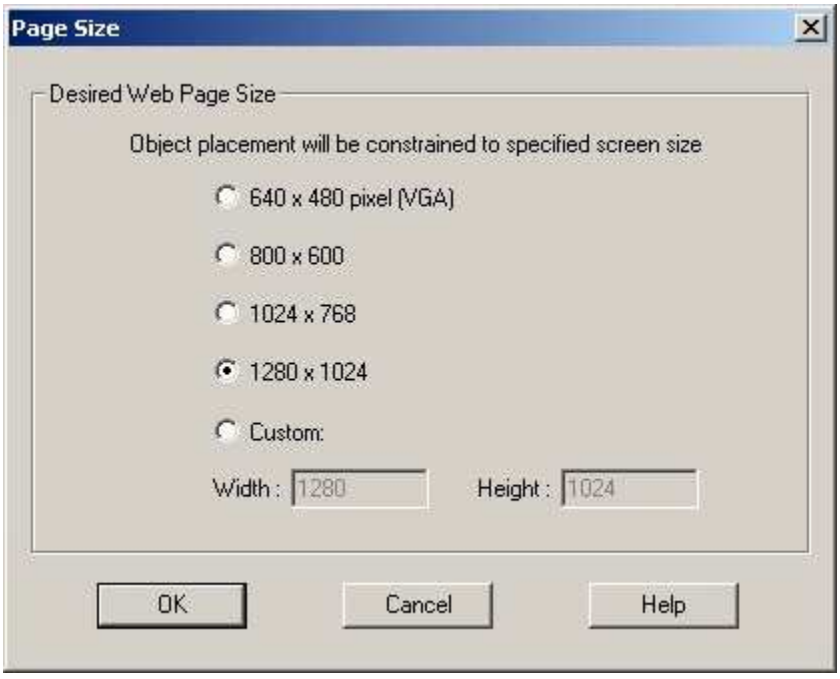


Resizing the Web Page

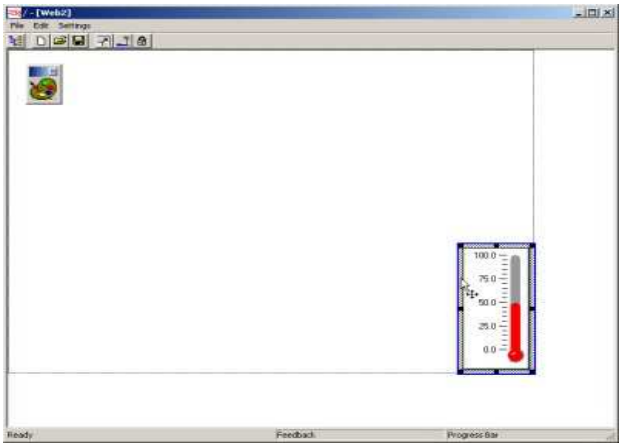
The Page Size option allows a selection of several standard sizes, as well as a custom option. This size is used to specify the area in which objects within the web page may be placed.

To adjust this Page Size, select the *Configure* option from the *Settings* menu. Alternatively the icon shown above may be selected from the toolbar.

These settings may be especially helpful when the target system has a different sized monitor than the PC where the Web Page was designed. The target system is the one that will be viewing the Web Pages using GreenWater™.

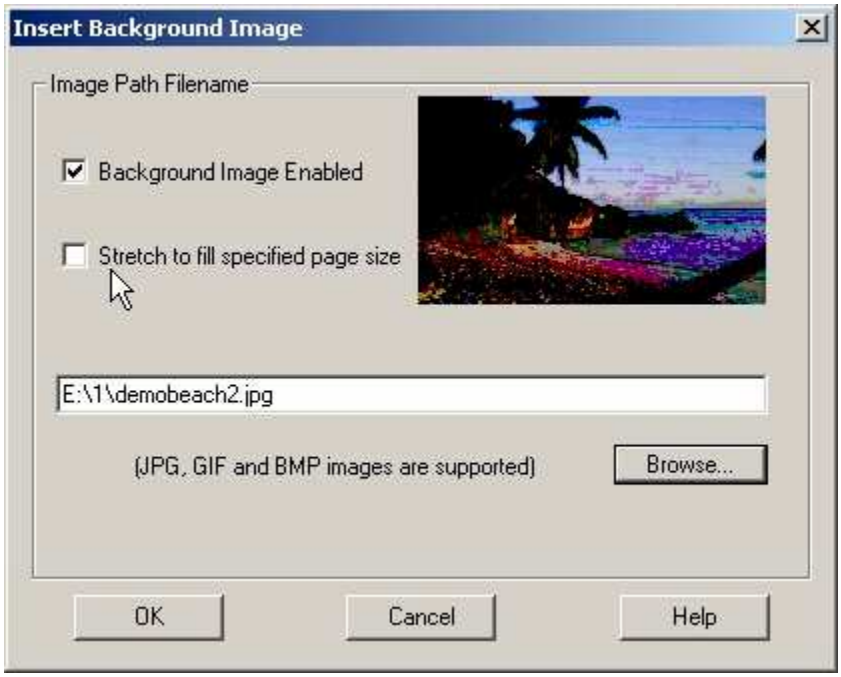


The boundary of the specified Page size will be displayed as a dotted line. Objects will be restricted to within this area.



Setting the Background

It is possible to assign a background image to Custom Web Pages. To select a background image, select the above icon from the toolbar.



To save space in the Logger, and to reduce loading time of Web Pages, it is recommended that all images be less than 180 KB in size.

Note: Converting a *.BMP file to *.JPG or *.GIF format usually reduces the size.

Web Design Palette

Similar in function to the Net Icon Palette, the Web Design Palette offers a selection of Web Page objects that may be used on the page. This floating palette is displayed on the RTT Window workspace. Hovering the mouse over the Palette will expand it, showing the available objects.

Most objects on the palette are used to display analog data. Many can set a threshold of 0.5 and can then be used to display logic data. A few Objects are special:

VALVE
The only object which applies only to Logic (High/Low) data is the Valve.

LABEL
This object is used for adding text on the Web Page.

IMAGES
In additional to the background image, small pictures such as a company logo can be added to the Web Page using this object.

HYPERLINK
This provides a quick reference to another Custom Web Page, or to a regular web page on the Internet.

PLOTTER
The plotter displays data for multiple data sources over time.

Web Page Objects

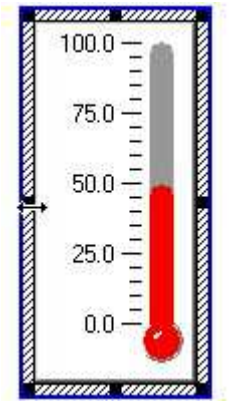
Web page objects do not interconnect, but the User can select, move, remove, or resize them. Each Web Page object has its own Configuration Dialog. After a Configuration Dialog is closed, the Object is redisplayed with all the latest settings, making it easy to experiment with different parameters.

Each object that displays data must be associated with a Probe Point from a Program Net.

> **Note:** These objects do not use Memory (RAM) icons. There must be a red Probe Point icon connected to a data point in order to monitor live data.

SELECTING OBJECTS ON THE WORKSPACE

Objects that are selected can be moved, resized or deleted. Click once on an object to put focus on it, and its resizing bars will appear around it. Only one Object at a time can be selected.



MOVING OBJECTS ON THE WORKSPACE

Just click anywhere on the body of an Object and then Drag & Drop to move it.

RESIZING OBJECTS ON THE WORKSPACE

Unlike icons, most RTT Objects can be resized. Click on any Stretch Point of a resizing bar and drag it to change the Object's size.

REMOVING OBJECTS FROM THE WORKSPACE

Click once on an object select it, then press the keyboard *Delete* or *Backspace* key. When a palette object is removed, its link to a Probe Point also removed.

Configuring Objects

Objects must be configured before they can be used. User configuration entails selection of various operational parameters such as association with a Probe Point, image file pathname, visible range, etc. All of this is simply done using the Configuration dialog associated with each object.

Configuring objects is similar to configuring icons. There are a few special settings, such as selecting colors or fonts, but the most important difference between icons and objects is the *Probe Point List*.

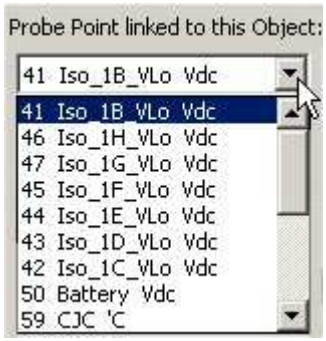
To configure an object that has been placed on the workspace, double-click on the graphic to show its Configuration dialog. Various standard Windows

techniques are used to select the different parameters within the dialog box, from text entry, to color and font editing, to selection via radio buttons.

Each object has a unique dialog box with programmable. Many parameters are common to these different types of objects. The items below illustrate typical configuration parameters within a configuration dialog.

PROBE POINT LIST

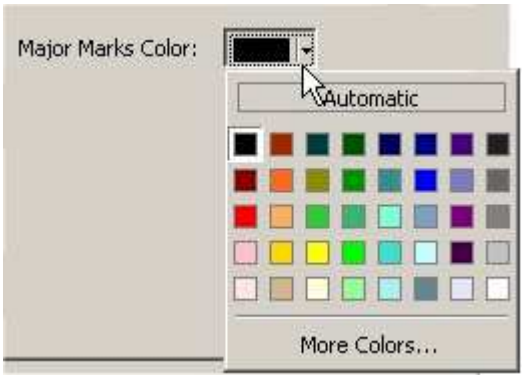
Instead of having an Icon Name, most Web objects are linked to a Probe Point (PP) icon from the Program Net. This can be selected from a pull-down list of available Probe Points. The unlabelled columns of the list are Probe Point number, Name and Units.



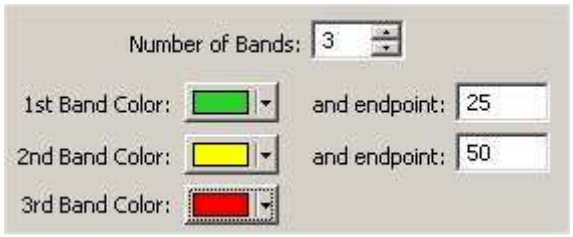
The associated Probe Point from the Program Net in the Logger will provide the data for this object, either on the Real-Time Trending Window or in a Custom Web Page viewed by GreenWater™.

COLOR

Most objects provide the ability to change one or more of its colors. All color selections use a standard pop-up dialog.

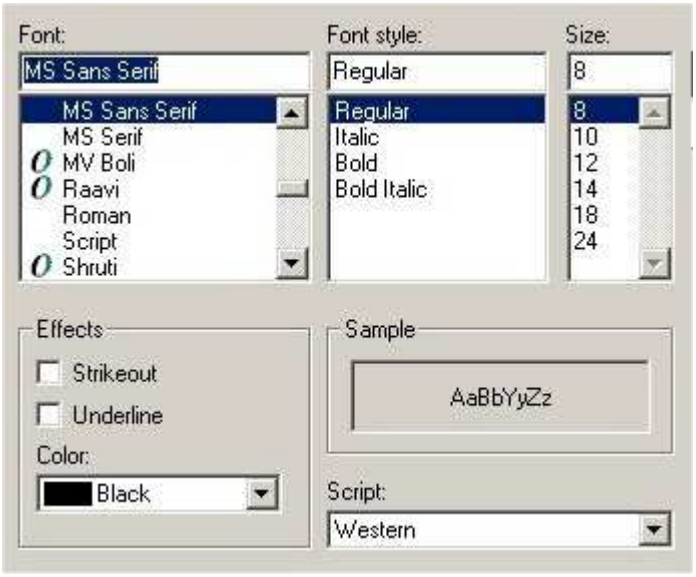


Some objects have color coding to differentiate ranges of values. Specify the total number of ranges and the boundaries between them.



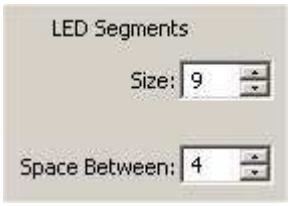
FONT

Fonts can be modified for text and numbers, by clicking on a *Font* button to pop-up a standard Windows Font Configuration Dialog.



SPIN CONTROL

Some numeric entry boxes have a spin control attached. This makes it easy to change values and ensure the number stays in its valid range. You can type in a number, or use the arrows to increment or decrement the number.



OBJECT BACKGROUND

Most of these objects offer the option of making the background transparent or colored, and with or without a border.

SCALE

This concept can be confusing at first. Most of the Analog data Objects provide two choices for displaying the tick marks and labels of the scale. *Fixed Scale* focuses on absolute endpoints, and *Auto Scale* focuses on the density of tick marks.

FIXED SCALE

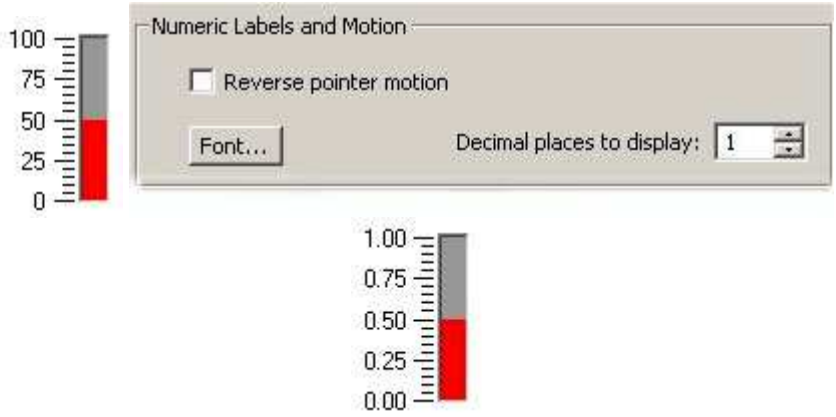
The minimum and maximum values must be specified and will never change. Spacing and labels are automatically assigned without any other information from the User.

AUTO SCALE

Select this to automatically rescale the control's limits when it receives values outside the present Min/Max range. When this is selected, specify the label density (number of visible tick marks) rather than the endpoints.

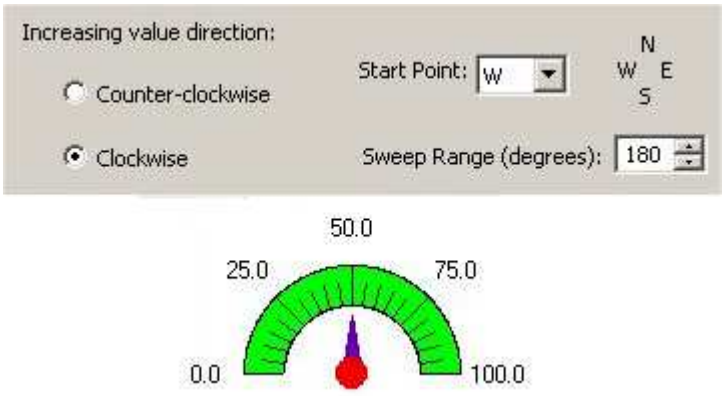
NUMERIC LABELS

The numeric labels of many objects are also readily configurable. For example, the scale on a gauge that runs from 0 to 100 might use no decimal places to label the major ticks, while another gauge that expects values from 0 to 1 might use 2 decimal places.



COMPASS

Certain objects display the data in a rotary manner. In order to simplify selection of allowed locations on the circle, the Compass Selection is provided. In the example below, to display a half-circle gauge only, the start point is set to West and the end point is 180 degrees from there, moving clockwise.

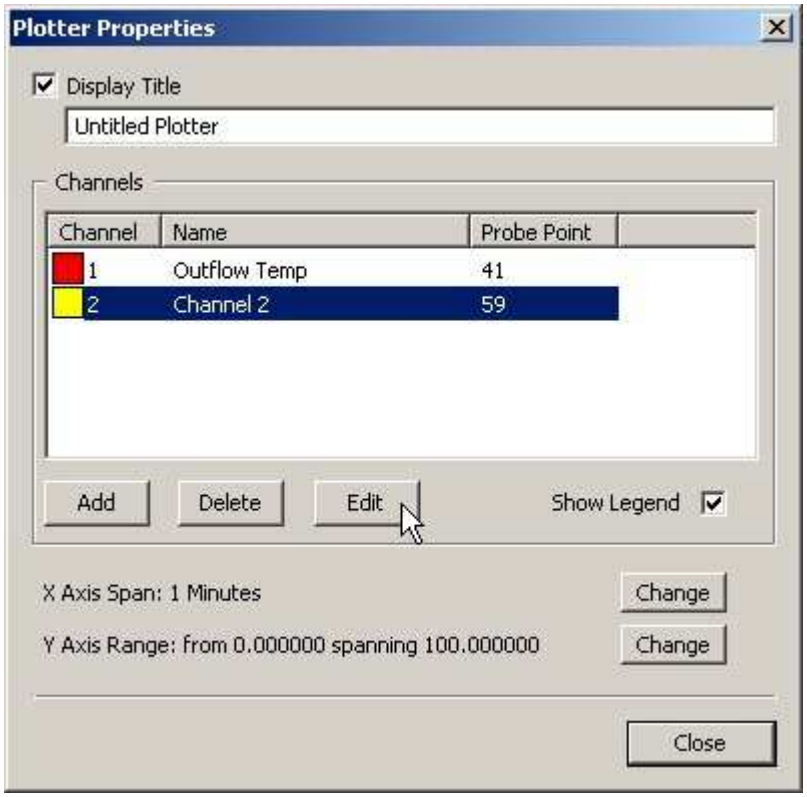


Plotter Object

The Plotter is unique for several reasons. It is the only object that can track more than one Probe Point. It is the only one that displays a history of values for each of its Probe Points over time. It also has its own set of toolbar icons.

MULTIPLE PROBE POINTS FOR PLOTTER

The Plotter can be associated with multiple Probe Points. The *Channel* section includes the Channel list and the Add, Delete and Edit buttons associated with it.



CHANNEL CONFIGURATION

Instead of one drop-down selection list, the Plotter provides individual configuration for each channel that the User adds. Each channel is typically associated with an individual Probe Point, which can be selected from the drop down list.

Save to File

After development of a Custom Web Page, it can be saved to a file using the *Save As* option from the *File* menu. Any images will be automatically saved in the same directory as the Web Page itself. Once this file has been saved to disk, it can be activated on the Real-Time Trending Window of HyperWare-II whenever the corresponding Program Net is running in the Logger.

VIEWING WEB PAGES

There are two ways to monitor “live” data in the Logger. Both HyperWare-II’s RTT (Real-Time Trending) Window and the stand-alone GreenWater™ application can graphically display the latest Probe Point readings using Custom Web Pages.

GREENWATER

GreenWater can access a Logger through its Ethernet connection (if it has one). Unlike browsers, it can also download the Custom Web Pages stored in the Logger and activate them to display live Logger data.

REAL-TIME TRENDING

From the RTT Window, Custom Web Pages can be designed and saved to files on the PC, or opened from files on the PC. A User can activate the RTT Window to display live Logger data by using the Logger Probe Point List icon and the VCR control buttons below.

For more information, please refer to Chapter 8, which describes Real-Time Trending.

12 DATA DOWNLOAD

OVERVIEW

Once data has been collected by the Logger it can be downloaded from Logger Memory to a PC, with a number of powerful data analysis and viewing options available from within HyperWare-II. The CF Card option provides the Logger with expanded data storage capacity and memory that can be transported to another location. For a Compact Flash (CF) card, the same HyperWare-II options can be used to process the data directly through a CF card Reader on the PC. Downloading CF data through the Logger is also possible, but is slower than using a CF card reader connected to a PC.

Logged data can be retrieved and saved to PC in any of the following date/time annotated file formats:

CSV Comma-Separated Variables

TSV Tab-Separated Variables

TXT Space-Separated columns with a fixed minimum width per column

XID Raw data in a special secure format

After data has been stored on a CF Card or in the Logger Memory, the collected data is transferred to a Download File on the PC. The following steps detail the procedure to download and perform file conversion to view or analyze this data:

Switch to the Communication Window

Open Download Dialog

Select the data to be downloaded

Specify the destination file format and filename

Launch the desired data review/analysis application (e.g. Plotter, Excel, Notepad, etc)

The *Data Processing* menu on the Communication Window provides the capability to `Post Process' (i.e. process after download) raw data (XID) files in the following ways:

Plot collected data in a powerful graphing module included in HyperWare-II

Filter data by time and/or by Memory channel for convenient analysis

Convert files into various User-selected formats, allowing seamless inclusion into other Windows applications such as word processors and spreadsheets

Verify the integrity of any XID file

FORMATS

To preserve configuration and analysis options, it is preferable to save data in XID when downloading it from the Logger or CF card. If the Logger is still collecting data during download, using the XID format will minimize the impact on the Logger, when running sub-second nets.

CSV, TSV

Most spreadsheets and databases recognize tab-separated or comma-separated file formats. These files begin with Header information located at the top of the file, followed by data which is laid out as one row per Timestamp. Each time the Program Net clocks trigger a set of readings, a new Timestamp is generated. The initial columns specify the date and time, then each data channel has a column for its readings.

TXT

This format is almost identical to tab separated, except that is has a fixed minimum width of 35 characters per column, using spaces where needed as padding. Viewing this file format is often assisted using a fixed width font such as Courier, which maintains column alignment.

XID

This is the fastest format to download due to the fact that it is the raw binary format used by the Logger containing compressed information and checksums. This format is not in human-readable form. It is also the only one that can be converted to other formats. More importantly, it is the *ONLY* format that can be plotted by HyperWare-II.

Size of Data Download Files

Selecting the “Limit Output File Size” checkbox allows the user to limit the maximum size of a data download file at the cost of creating additional numbered files. For example, if a 148KB data session is saved as a CSV file with the name “readings” and the limit is set to 64KB, HyperWare will create two 64KB files named *readings-000000.csv* and *readings-000001.csv* and a 20KB file named *readings-000002.csv*.

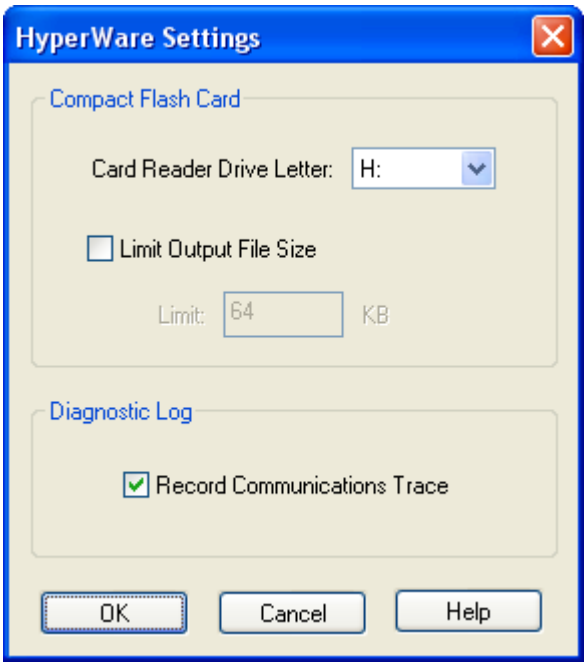


Figure 12-1; HyperWare Settings Dialog

Data Download Steps

Open Download Dialog

Go to the Communication Window and decide whether to download data directly from the Logger, or through a CF card reader on the PC. Although it is possible to leave the Logger enabled while downloading CF card data, because of the volume of data it is much faster to stop the Current session and take the CF card to a reader on a PC.

> **Note:** when running sub-second nets, minimize impact when downloading data by having the PC do any format conversion, not the Logger.

CF Card

Press STOP on the Logger front panel. Remove the CF card with the Eject button. Insert the card into an appropriate Card Reader on the PC. In the Communication Window, double click the card reader image or alternatively select the *Scan Card* option from the *Compact Flash Card* menu.

Figure 12-2; Downloading Data from a CF Card

After this, double-click the RAM icon that appears on the CF card image to open the Data Download dialog, or alternatively select the *Download Data* option from the *Compact Flash Card* menu.

Logger On-board Memory

Data downloads can be performed while the Logger is Enabled and executing a Program Net. To download directly from the Logger to the PC, click on the RAM memory icon overlaying the Logger image on the Communications Window, and drag it to the PC image then release it.

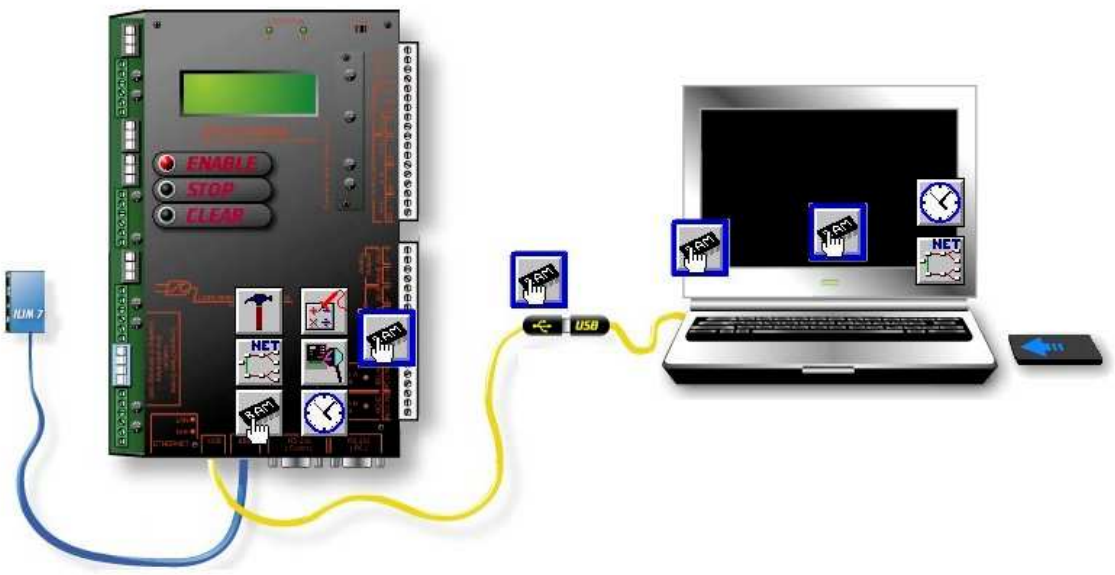


Figure 12-3; Downloading Data From Logger On-board Memory

Menu Commands

Alternatively, select the *Download Data from Logger* option from the *Logger* menu to open the Data Download dialog.

Figure 12-4; Downloading Data From Logger Menu

SELECT THE DATA TO BE DOWNLOADED

Each time the Logger is enabled, a new data logging session is initiated. The Logger automatically assigns the name for each new session, so it will be unique, though cryptic. If a session is currently enabled, it has not stopped, so the stopped Date/Time is shown in asterisks, and the size is only an approximation, as highlighted below.

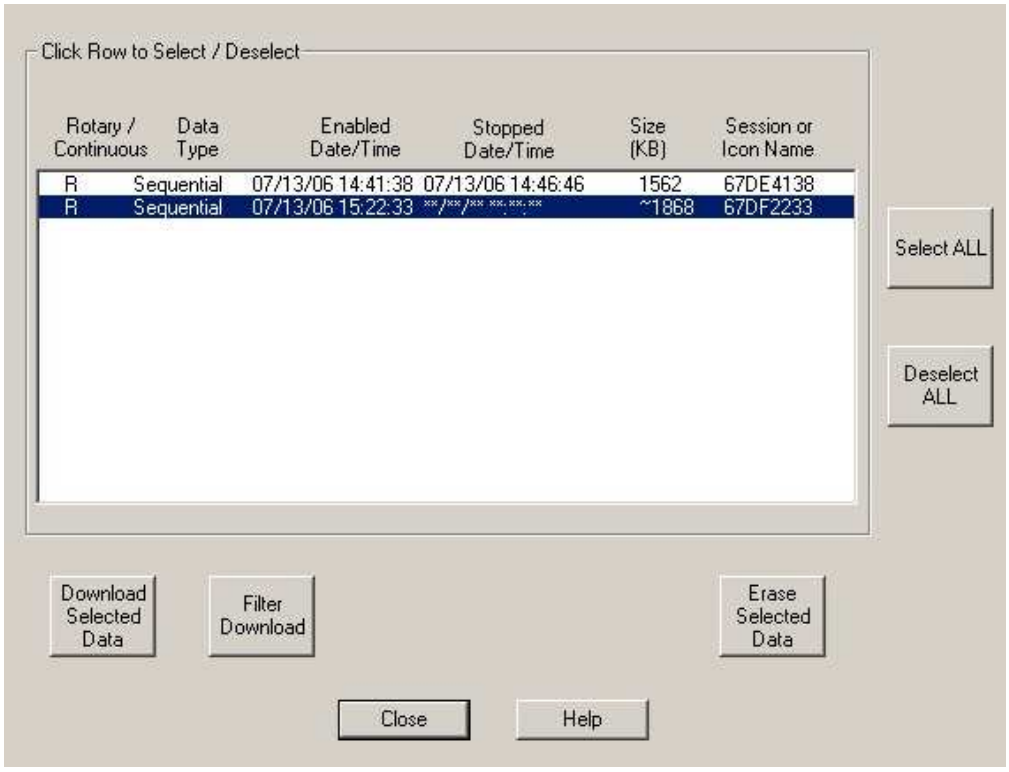


Figure 12-5; Logged Data Listing Dialog

Highlighting

Click individual rows to select them or use the *Select All* or *Deselect All* buttons to perform operations on all rows at once. Select session(s) according to the time of Enable/Stop. Then click on one of the command buttons described below.

Erase Selected Data

This will delete all data that is selected.

Download Selected Data

This will pop up a standard File Save dialog, explained below. All of the highlighted data sessions will be saved in the same format, with a separate file for each session.

Filter Download

This command button is disabled unless there is exactly one session highlighted. Selecting this option displays the same Dialog that is used to convert raw data (XID) files to other formats. The two types of filter (Channel, Time) can be used to extract part of the data from this one selected session.

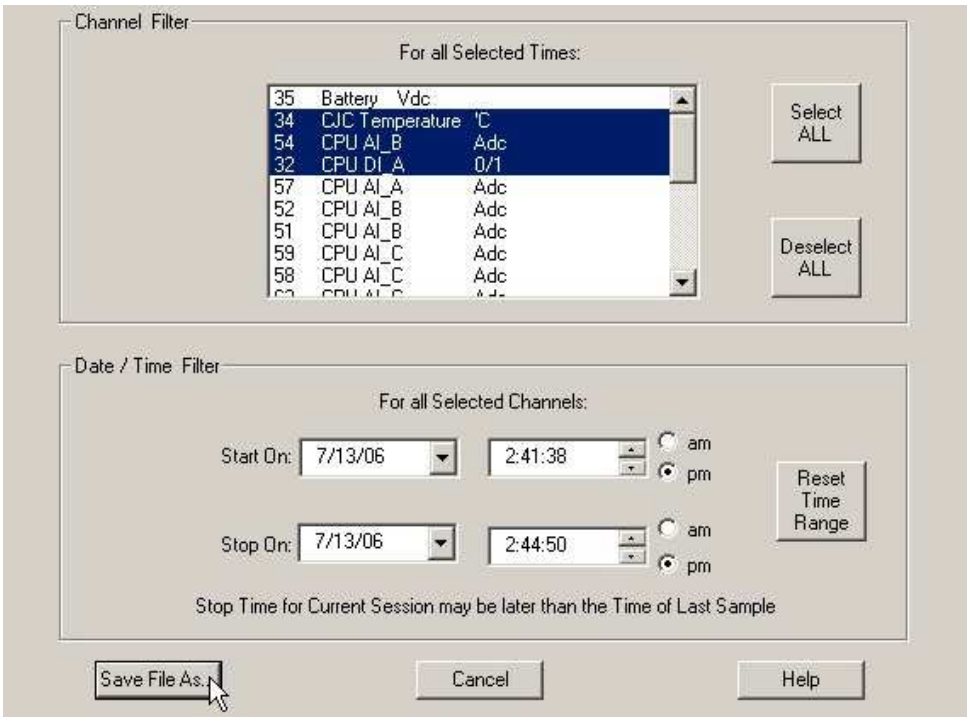

Channel Filter
For all Selected Times:
35 Battery Vdc
34 CJC Temperature 'C
54 CPU AI_B Adc
32 CPU DI_A 0/1
57 CPU AI_A Adc
52 CPU AI_B Adc
51 CPU AI_B Adc
59 CPU AI_C Adc
58 CPU AI_C Adc
Select ALL
Deselect ALL
Date / Time Filter
For all Selected Channels:
Start On: 7/13/06 2:41:38 am pm
Stop On: 7/13/06 2:44:50 am pm
Reset Time Range
Stop Time for Current Session may be later than the Time of Last Sample
Save File As...
Cancel
Help

Figure 12-6; Filter Download Dialog

CHANNEL FILTER
Highlight a Channel to include its data in the output file. As in Web Page Design and Real-Time Trending, the Channel List displays the ID number, the name of the Memory icon, and its Units.

DATE/TIME FILTER
The dialog initially displays the start and end times of the selected data session. The Reset Time Range button will undo any changes that are been made to these times. Attempting to specify times outside of the original data session range will not include any data outside the session.

SPECIFY THE DESTINATION FILE FORMAT AND FILENAME

A File Save dialog is used for downloading data from a CF Card Reader, for downloading directly from the Logger, or for downloading Filtered data from a single session. Specify the destination path and filename, which HyperWare should use when saving the files being created.

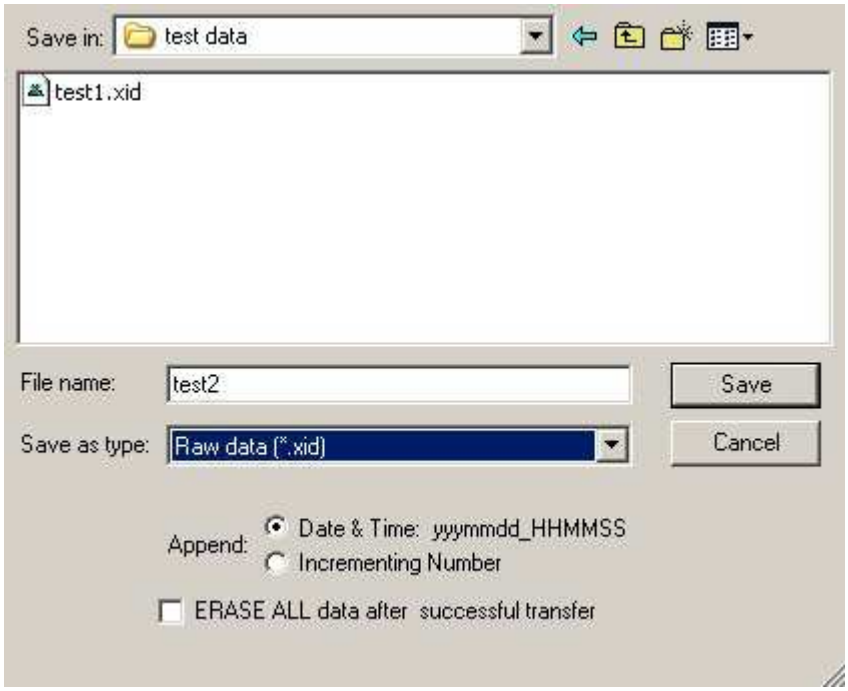


Figure 12-7; File Save Dialog

Save as type:

Select one of the formats described above and choose a corresponding filename for the data file. Excel, Notepad, etc. can use text-formatted files, but the plotter will only accept files in raw data (XID) format.

> **Note:** Only complete sessions can be used to form an XID file. It is not an option when saving Filtered data.

Append

If multiple sessions are selected, these two radio buttons appear to ensure a unique filename for each session. The base *File name* will append either a simple sequence *Number* or a complete timestamp. The timestamp is actually the date and time of the start of the session. It is derived from the encoded session name, and is formatted as shown.

ERASE ALL data after successful transfer

If the *ERASE ALL*…. Option is selected, at the end of a successful transfer, an attempt will be made to erase the selected sessions.

> Note: Only complete sessions can be erased, not Filtered data.

DATA REVIEW/ANALYSIS

The Plotter accepts raw data (XID) format files. This is a binary, compressed file, so contains no human readable data. Applications such as Excel, Notepad, or other text-based applications may open files of the other formats.

Note: Some Windows applications have limited viewing capacity, such as Excel (65535 rows).

DATA PROCESSING

There are three ways to process Raw Data files (*.XID) that are downloaded from the Logger or from a CF card. The data can be plotted, converted to various text formats, or checked to verify the integrity of the file.

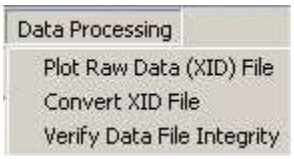


Figure 12-8; Data Processing Menu

After selecting any of these functions a File Open dialog will be shown, allowing selection of the XID file.

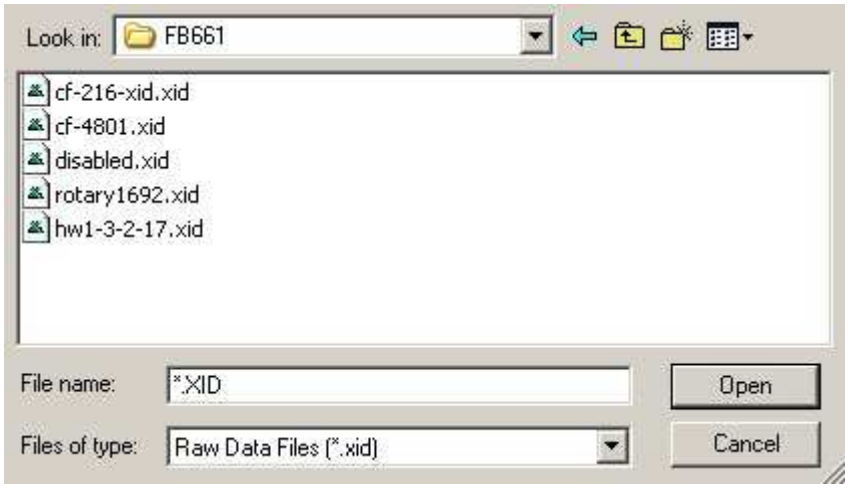


Figure 12-9; File Open Dialog

VERIFY DATA FILE INTEGRITY

After the XID file is selected, the verification process begins. The result will be displayed in a pop-up dialog.

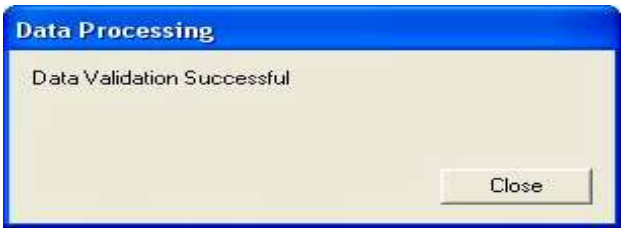


Figure 12-10; Verify Data File Integrity Dialog

Data Validation Successful means the data has not been tampered with or otherwise corrupted.

Figure 12-11; Data Verification Problem Dialog

Any problems encountered will be displayed, indicating possible tampering or corruption of the original data.

CONVERT XID FILE

This dialog is the same Dialog that is used to Filter Downloaded data from a single session. The two types of filter (Channel, Time) can be used to extract part of the data from this one session. To include all data, use the *Select All* and *Reset Time Range* buttons.

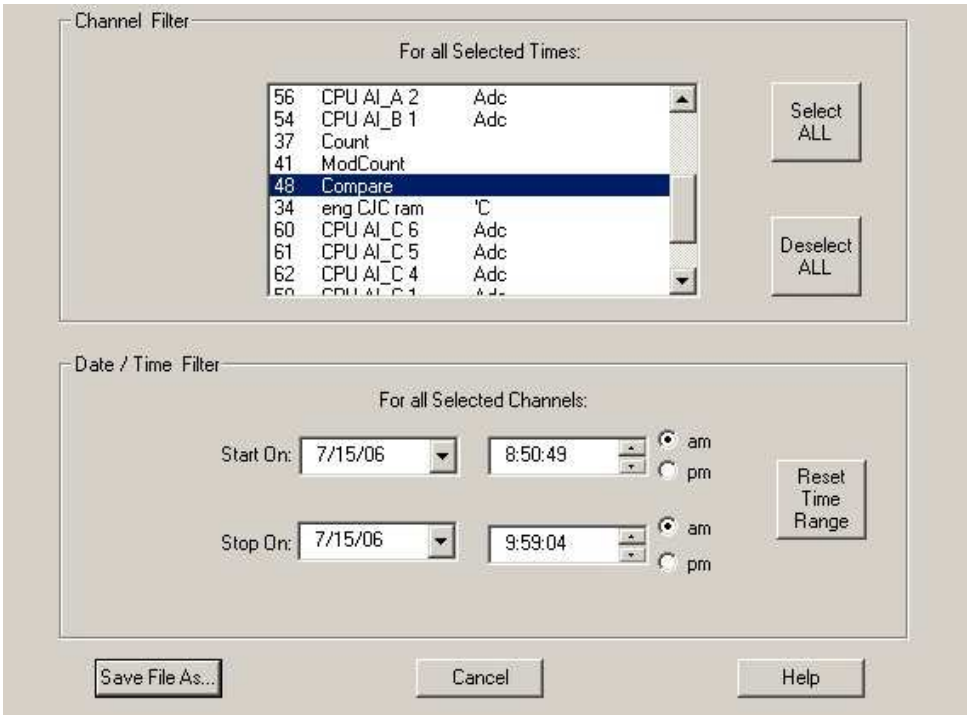


Figure 12-12; Convert XID File Dialog

XID files can be converted to any of the three formats shown below:

Figure 12-13; File Save Dialog

PLOT RAW DATA (XID) FILE

After the XID file is selected, it the data will be processed and the plotter output will appear. Each Memory (RAM) icon will be automatically assigned to a unique channel.

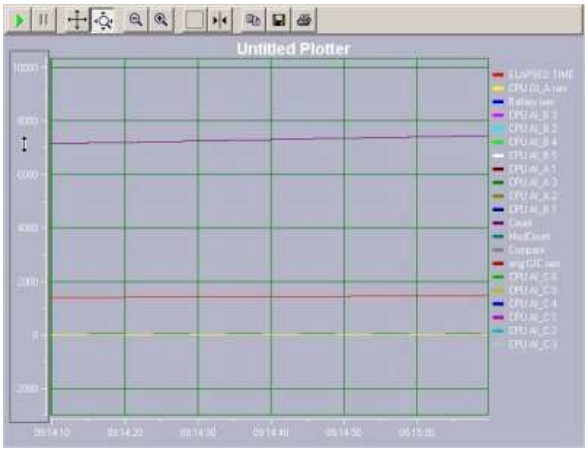


Figure 12-14; Plotter Output

Standard Windows Functions

There are toolbar icons for several familiar functions such as Copy, File Save and Print.

Use this toolbar icon at any time to revert to the initial display as the file was loaded.

Zooming

This is a special Axis Zoom function. When this toolbar icon is active, clicking on an axis and dragging it will move the display in that direction. Note that the time axis remains the same in the Before and After images below when altering only the vertical scale.

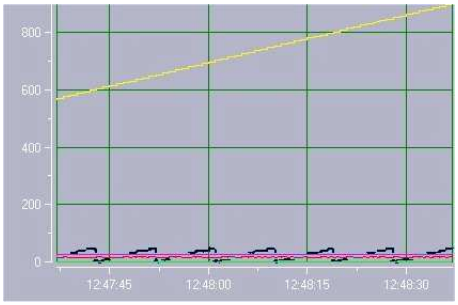


Figure 12-15; Plotter Before Vertical Zoom

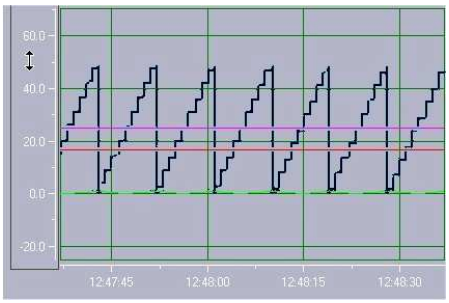


Figure 12-16; Plotter After Vertical Zoom

When this toolbar icon is active, clicking and dragging allows selection of an area of the plot to be zoomed.

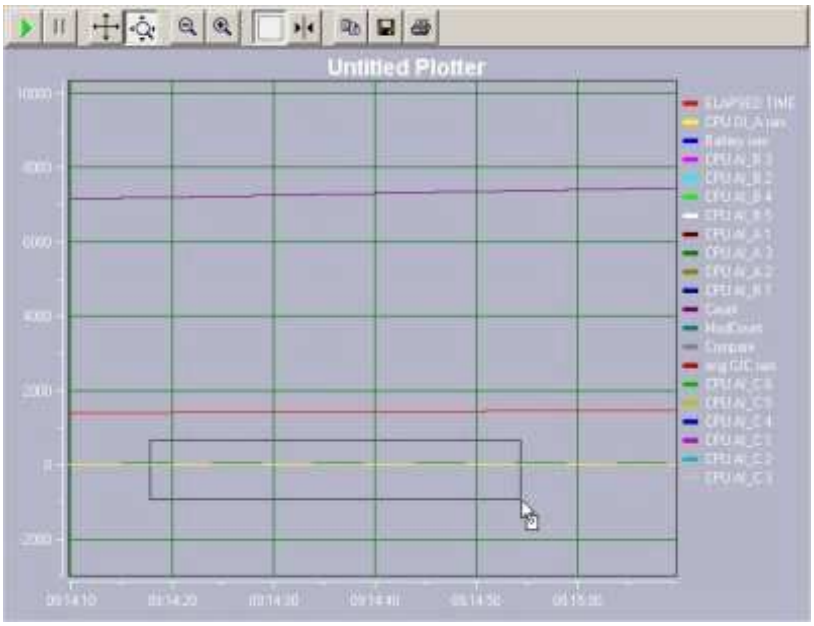


Figure 12-17; Plotter Before Selection Zoom

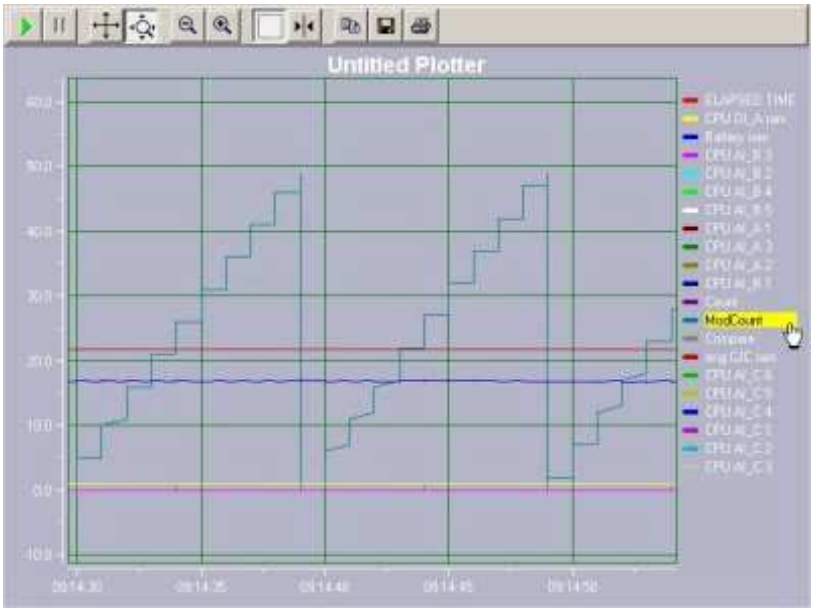


Figure 12-18; Plotter After Selection Zoom

Axis Adjustment

When this toolbar icon is active, you can grab an axis and drag it to scroll the data. In the example below, moving the time points to the left will reveal future data on the right, and the oldest data visible will scroll out of view on the left.

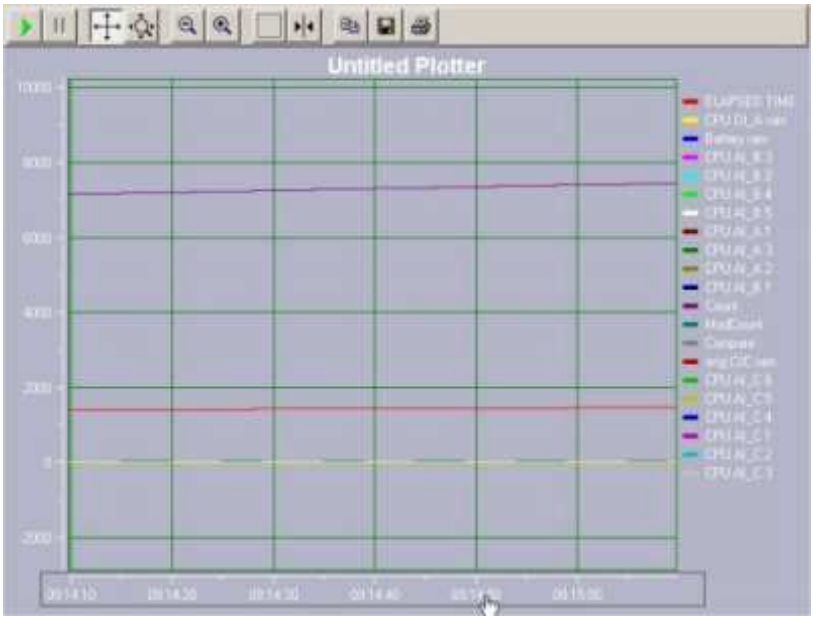


Figure 12-19; Plotter Using Axis Adjustment

13 GREENWATER™ BROWSER INTERFACE

OVERVIEW

GreenWater has the "Look & Feel" of a standard web browser. It provides the same primary capabilities as most browsers, with the additional power to display live Logger data according to the user's graphical design. Any browser can connect to a Logger via Ethernet to access the Standard Logger web pages (with proper validation), but only GreenWater can display the Custom Web Pages within the Logger itself.

MENU/TOOLBAR COMMANDS

GreenWater offers a number of standard browser menu commands, with associated toolbar icons.

File

The File Menu allows the User to check on the *Page Properties* of the page being viewed, to bookmark the current page with *Add to Favorites* or to *Exit* the GreenWater application.

View

The View Menu provides access to changing the *Font* size of text on a page, or toggling the visibility of the *Status Bar*. The *Stop* and *Reload* options in the View menu control activity on the page, especially on a Custom Web Page.

Go

The Go menu provides navigational shortcuts, allowing the user to *Back* to previously viewed web page, or *Forward* again. The *Start Page* option on the Go menu is a shortcut back to the User's startup (Home) web page. The *Search* option is a shortcut to the currently defined web-searching page.

Favorites

GreenWater uses the same Favorites list (a.k.a. Bookmarks) as the Internet Explorer browsers. Anything added here would appear in the Favorites list in Internet Explorer.

LOGGER WEB PAGES

To connect to a Logger, simply enter its Ethernet IP address in the Address bar. Once connected, a header is displayed above the four Tabs for the Logger Web Pages.

Standard Web Pages

The first three tabs provide access to the Standard Logger Web Pages. These provide status, access to data in textual format, and the ability to control Remote Switches through software.

Custom Web Pages

Custom Web Pages are part of the Program Net in the Logger, and can only be viewed with GreenWater. They provide graphical displays of Real-Time data. These Custom Web pages can be created or modified using the HyperWare application.

HOME/STATUS TAB

The Standard Status web page identifies the specific Logger and displays information about Battery voltage levels and about the amount of Memory used and available. It also provides access to any programmable messages that may be displayed on the LCD screen of the Logger.

TITLE

The heading displays Logger Time and Operational Mode.

Current IntelliLogger™ Status

Unit Date and Time: 11/21/2006 14:32:03

Operational Mode: Logging Enabled - Internal Memory - Memory Full

Logger Time

This displays the current Date and Time of a Logger. The Logger clock can be adjusted from the Communication Window of HyperWare. All timestamp values used for “Logger Time” when logging data will use this clock. This displays the time of the Logger only when the page was first opened (the time displayed does not update automatically). Logger time does ***not*** change back and forth in accordance with Daylight Savings automatically, because it would cause an overlap of timestamps in the data.

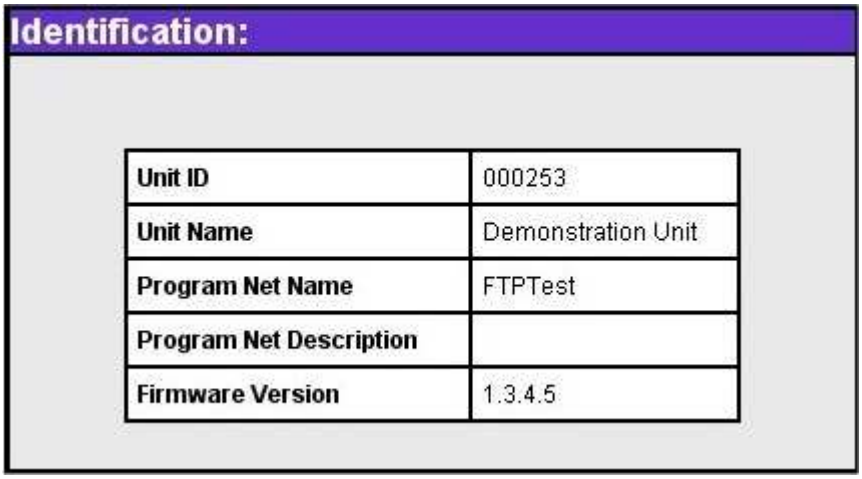
Operational Mode

The Operational Mode indicates whether the Logger is enabled, downloading data, stopped or in some other operational mode. It also shows whether it is

storing data to Internal Memory or to an external CF card, and gives a summary of memory usage. Greater detail on the amount of memory used and available is provided below.

IDENTIFICATION

Identification information not only includes the ID and Name of the Logger, it also specifies which Program Net is loaded in it, and provides a quick lookup of the firmware (internal code) version.



ACTIVE MESSAGES

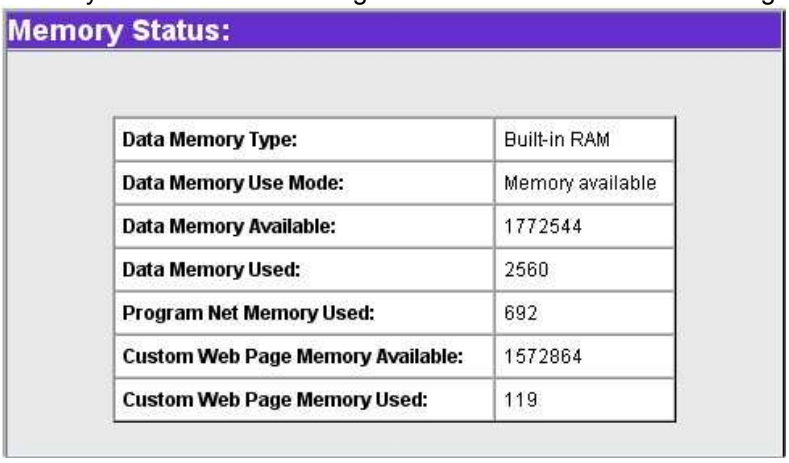
LCD screen messages (e.g. alarms) can be easily reviewed here. These same messages could be viewed on the LCD screen of the Logger, by using its Next and Select buttons to advance through the LCD menus.

Most messages can be cleared from the list on either the LCD screen or the Standard web page. System Messages, such as “Logger has been reset” and messages generated by a two-line Latched LCD Message (event) icon can be cleared. Three-line messages from the Conditional LCD Message icon continually update current status, so these cannot be cleared manually.

When *Clear Selected Messages* is clicked, only selected messages will be erased.

MEMORY STATUS

The information provided here includes details about Data Memory as well as about Memory used to store the Program Net and the Custom Web Pages in the Logger.


Memory Status:
Data Memory Type: Built-in RAM
Data Memory Use Mode: Memory available
Data Memory Available: 1772544
Data Memory Used: 2560
Program Net Memory Used: 692
Custom Web Page Memory Available: 1572864
Custom Web Page Memory Used: 119

Data Memory Type will be either “Compact Flash Card “ or “Built-in RAM.”

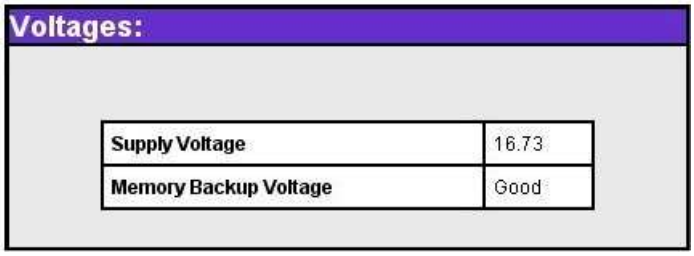
The *Data Memory Use Mode* depends on the Setting within the Global icon of the Program Net currently loaded in the Logger. There are three choices as to what the Logger should do when it fills Memory. If it has not yet filled memory, *Data Memory Use Mode* may show “Rotary mode” or “Memory Available.”

Once memory has become filled, the Logger may stop, or continue running without storing data, or wrap around and overwrite the oldest data. In these instances, *Data Memory Use Mode* would display either “Rotary mode - Wrapping” or “Memory Full.”

A certain amount of overhead space is reserved, which may vary from one Program Net to another, so *Data Memory Used* will generally never be as much as *Data Memory Available,* even when full.

VOLTAGES

Two battery sources are monitored: the Supply Voltage that powers all the boards of the system, and the round Lithium battery located within the CPU to sustain Memory. If *Memory Backup Voltage* shows "LOW - Replace Battery" instead of "Good" tend to it promptly to preserve data integrity.

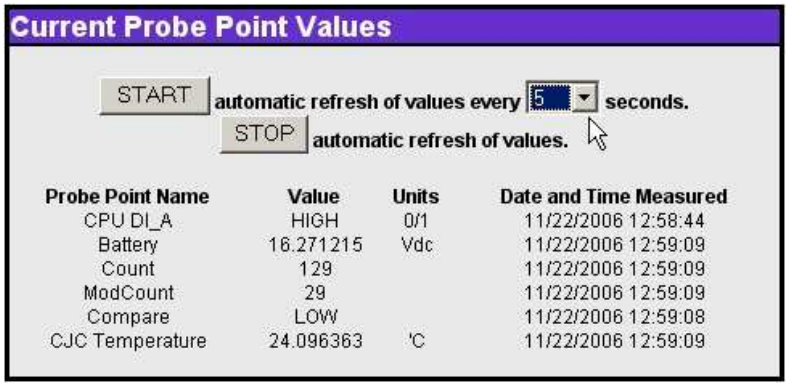


CURRENT VALUES AND CONTROL TAB

The left side of the display displays current Probe Point data. The right side provides the means to remotely control certain icons within the Program Net.

CURRENT PROBE POINT VALUES

In a Program Net, Probe Point icons provide a way to monitor Real-Time data, as opposed to the Memory icons that record values.

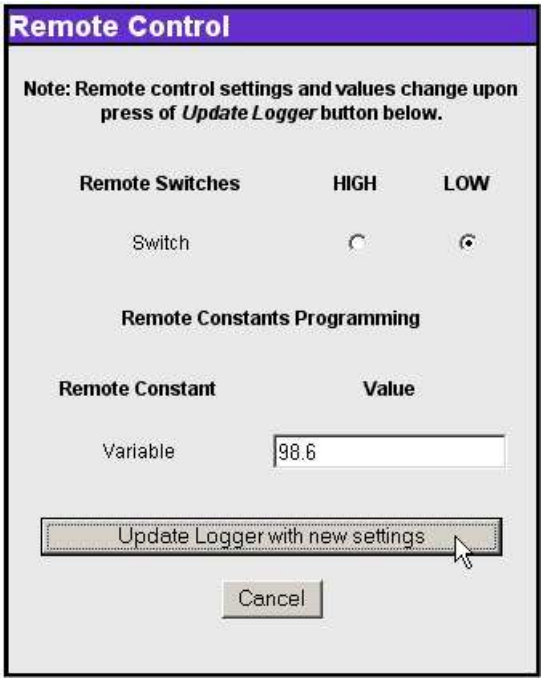


In the Current Probe Point Values display, the most recent reading for each Probe Point is shown with its timestamp. The timestamps may differ if differing Sample Rate Clocks drive the icons.

Selecting a number of seconds from the drop down list and clicking *START* will cause the web page to continually refresh at that frequency. Clicking the *STOP* button halts further updates.

REMOTE CONTROL

It is possible to remotely control the Logger using Remote icons within the Program Net.



Each Remote icon in the Logger's Program Net can be accessed from this Standard web page.

REMOTE SWITCHES
(A.k.a. Remote Control icons) are digital, so they may be set to either a High or Low state.

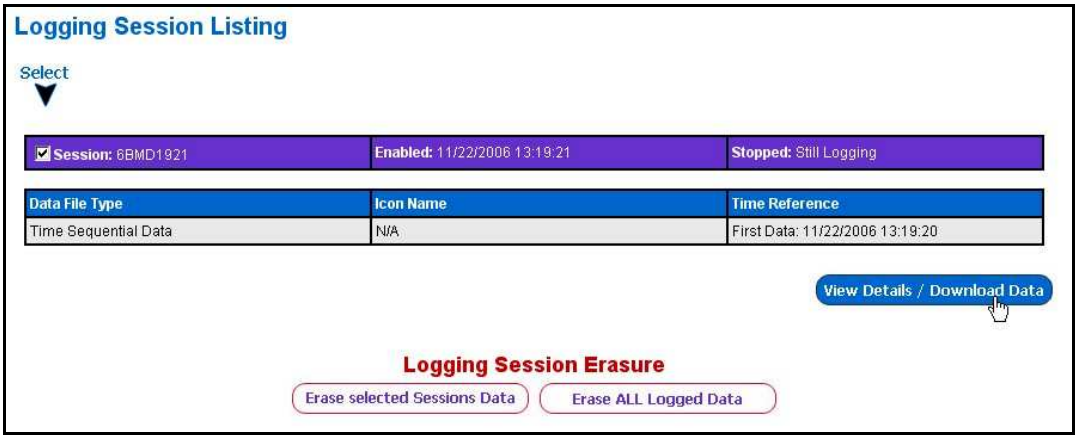
REMOTE CONSTANTS
(A.k.a. Variable icons) have analog values, which can be changed using an edit box.

> **Note:** There is no way to revert to prior settings automatically, so it would be wise to record the values before changing them.

When all values are set as desired, clicking on *Update Logger with new settings* will send all of the values to the Logger at once. Each setting will take effect on its next net scan, when whichever clock drives the corresponding icon causes it to be updated.

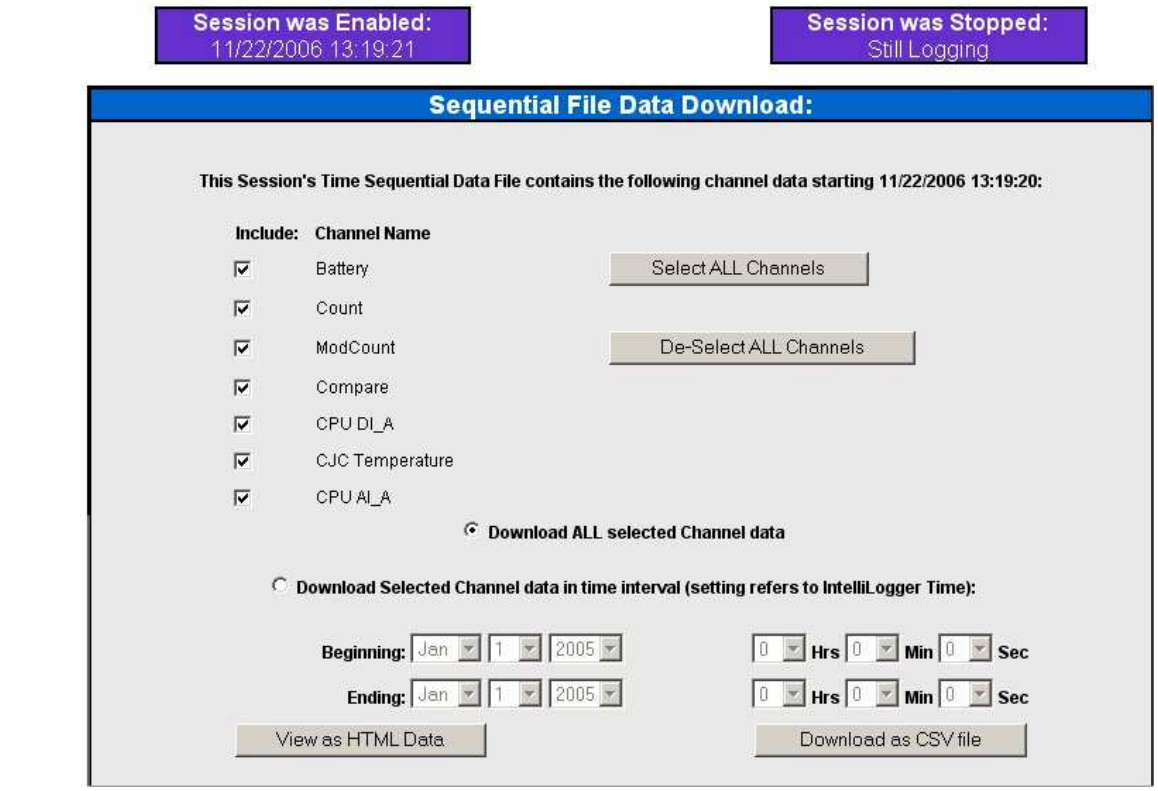
LOGGED DATA LISTING TAB

The Standard Web Page for Data Logged to Memory offers format translation viewing, downloading to the PC or erasing of the data.



VIEW / DOWNLOAD DATA

Data can be viewed from the Standard web page either in *HTML* (web page) format, or in *CSV* (Comma-Separated Variables) format, which can be saved to disk or opened by a spreadsheet or database program such as Excel™.



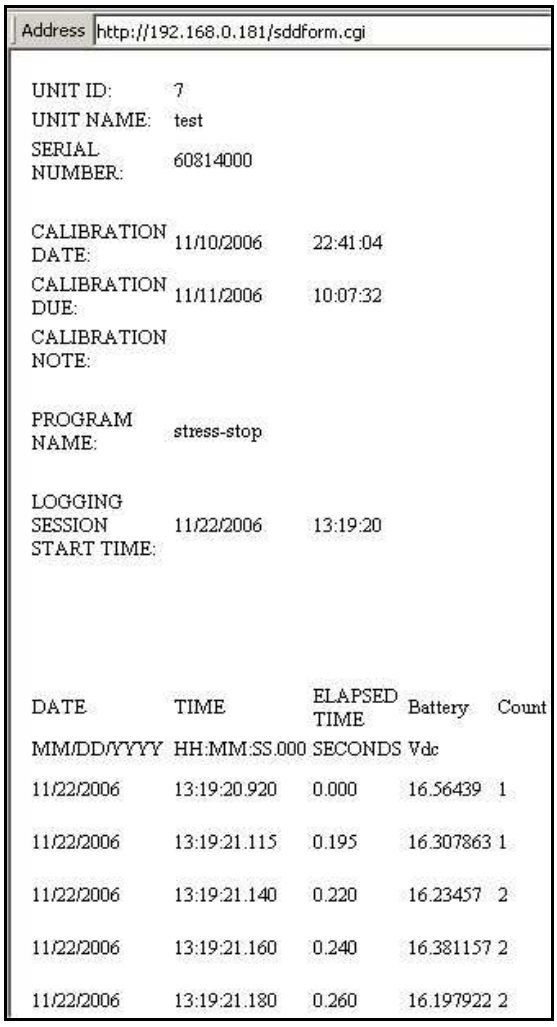
Filtering

Unless using the default of All data in the session, the Channels and range of Time must be selected. Channels are individual RAM icons from the Program Net. Check boxes to select channels.

The two radio buttons determine whether to use the full Time Range (*Download ALL selected Channel data*) or to permit specification of *Beginning* and *Ending* Date/Time.

View as HTML Data

Clicking on *View as HTML Data* causes GreenWater to generate a temporary Web page in which the selected data will be displayed.



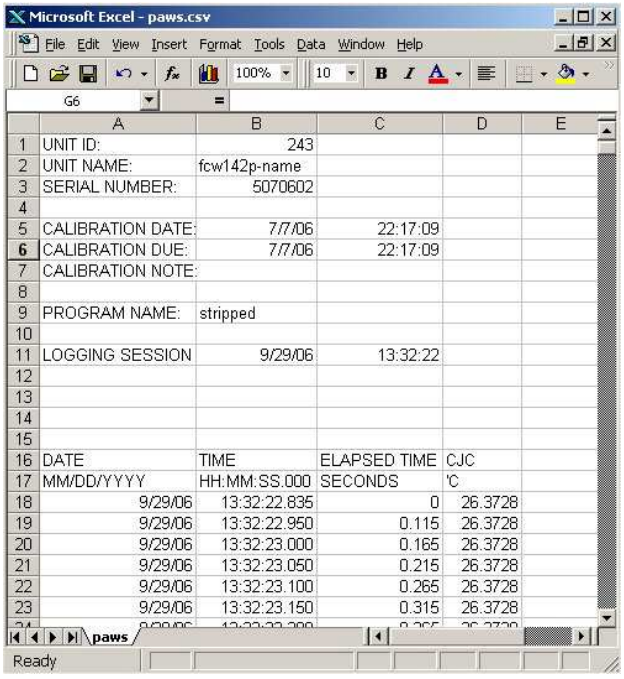
Address http://192.168.0.181/sddform.cgi

UNIT ID:	7	
UNIT NAME:	test	
SERIAL NUMBER:	60814000	
CALIBRATION DATE:	11/10/2006	22:41:04
CALIBRATION DUE:	11/11/2006	10:07:32
CALIBRATION NOTE:		
PROGRAM NAME:	stress-stop	
LOGGING SESSION START TIME:	11/22/2006	13:19:20

DATE	TIME	ELAPSED TIME	Battery	Count
MM/DD/YYYY	HH:MM:SS.000	SECONDS	Vdc	
11/22/2006	13:19:20.920	0.000	16.56439	1
11/22/2006	13:19:21.115	0.195	16.307863	1
11/22/2006	13:19:21.140	0.220	16.23457	2
11/22/2006	13:19:21.160	0.240	16.381157	2
11/22/2006	13:19:21.180	0.260	16.197922	2

Download as CSV file

Selecting *Download as CSV file* offers the choice of saving the data to file or viewing it with a spreadsheet program.



	A	B	C	D	E
1	UNIT ID:	243			
2	UNIT NAME:	fcw142p-name			
3	SERIAL NUMBER:	5070602			
4					
5	CALIBRATION DATE:	7/7/06	22:17:09		
6	CALIBRATION DUE:	7/7/06	22:17:09		
7	CALIBRATION NOTE:				
8					
9	PROGRAM NAME:	stripped			
10					
11	LOGGING SESSION	9/29/06	13:32:22		
12					
13					
14					
15					
16	DATE	TIME	ELAPSED TIME	CJC	
17	MM/DD/YYYY	HH:MM:SS.000	SECONDS	°C	
18	9/29/06	13:32:22.835	0	26.3728	
19	9/29/06	13:32:22.950	0.115	26.3728	
20	9/29/06	13:32:23.000	0.165	26.3728	
21	9/29/06	13:32:23.050	0.215	26.3728	
22	9/29/06	13:32:23.100	0.265	26.3728	
23	9/29/06	13:32:23.150	0.315	26.3728	

If *Save to File* is selected, a File Save dialog will be shown, allowing you to specify the filename. If *Open* is selected, the default spreadsheet application will be used to display the data.

LOGGING SESSION ERASURE

Many Users want to “clean up” after downloading data. The Logged Data Listing Tab of the Standard web pages provides two methods erasing data that the User considers obsolete.

Erase ALL Logged Data

This will simply clear the data logging memory. If a CF card is being used, it will be cleared of all Logger data, but if it originally had other files (such as pictures) these will remain intact. If internal Memory is being used for data, then that will be cleared.

If the Logger is still running when it receives the command to clear Memory, it will erase all data up to the time of the request, and proceed to log new data.

Erase selected Sessions Data

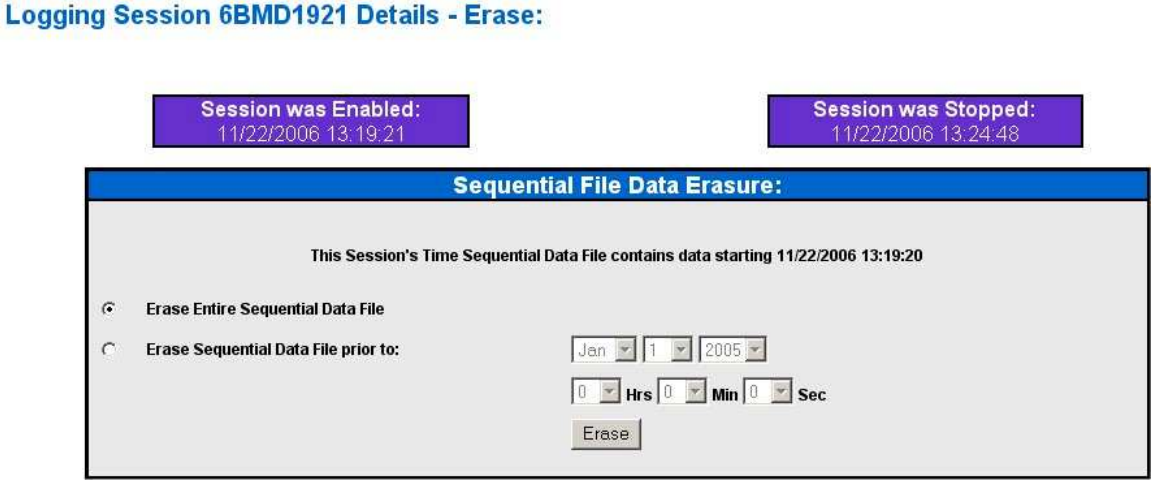
A new Data Logging Session is automatically started each time the Logger has been stopped and is then enabled. If there are multiple sessions of data, the User can select an individual session by checking its checkbox. Clicking on the Erase selected Sessions Data button only pertains to the sessions whose checkboxes have been selected. The Standard web page then changes to display the following for each session:

SESSION NAME

DATE/TIME OF START AND END

RADIO BUTTONS FOR TIME SEGMENT

DATA/TIME ENTRY FOR THRESHOLD (disabled if not applicable)



When the *Erase Sequential Data file prior to* radio button is selected, only the data before the time specified in the edit boxes will be deleted from the session.

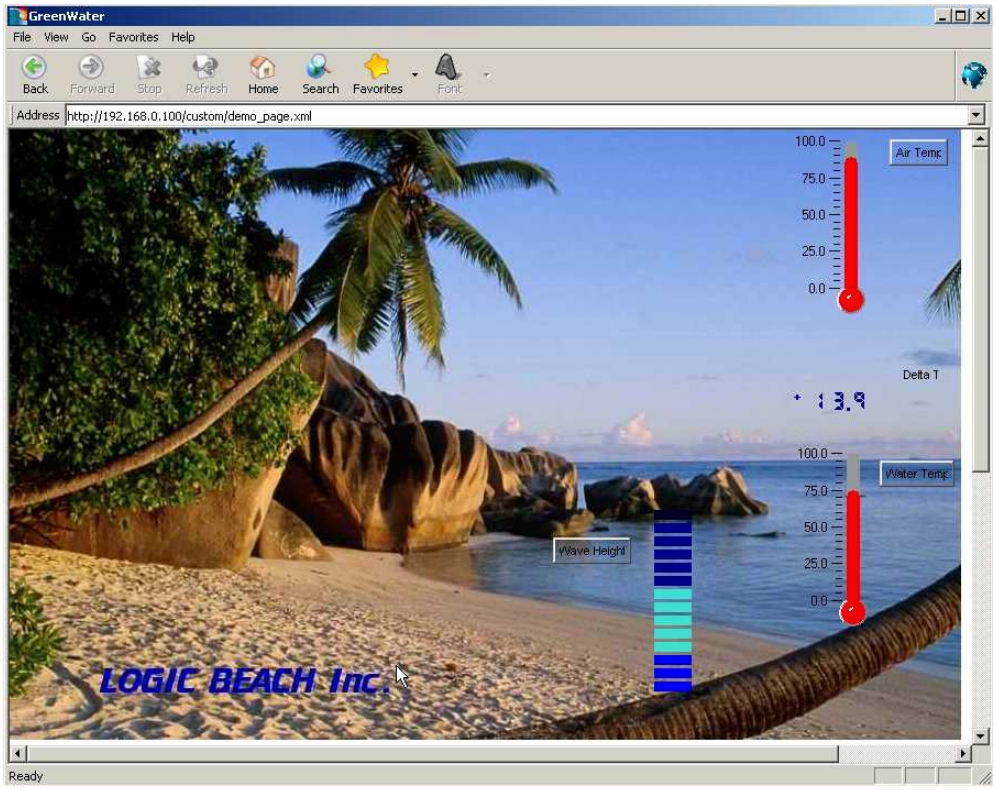
If the *Erase Entire Sequential Data File* radio button is selected, clicking on *Erase* will clear that entire session from memory.

CUSTOM PAGES TAB

In GreenWater™ this Tab will list the available Custom Web Pages stored in the Logger. When viewing with some other browser, this Tab provides instructions for downloading a free copy of GreenWater™.

Address http://192.168.0.100/custom-pages.htm
LOGIC BEACH Inc.
The authority in unrestricted data logging
SERVED BY INTELLILOGGER™
000253
Demonstration Unit
HOME / STATUS
CURRENT VALUES & CONTROL
LOGGED DATA LISTING
CUSTOM PAGES
The following IntelliLogger™ Custom Web Pages are available for viewing with GreenWater™
demo_page_scrolling
demo_page
Click on the above links to view the IntelliLogger™ Custom Web Pages.
Home/Status | Current Values & Control | Logged Data Listing | Custom Pages

The listed Custom Web Pages are hyperlinks that may be clicked to view graphical displays of the latest readings for selected Probe Point icons in the Program Net. Again, these Custom Web Pages may be defined within the HyperWare application and will form part of the Program Net.



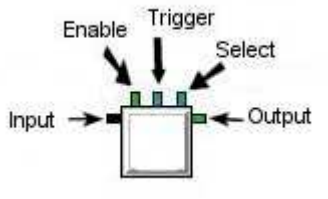
14 APPENDIX A: PROGRAM NET PALETTE ICON REFERENCE

This Appendix contains detailed reference documentation for the various icons that are available on the Icon Palette and used during the construction of a Program Net. Details on Configuration, applications, and proper usage are described here.

Icons representing hardware channel Inputs and Outputs are covered in Appendix B (System Base Icon Reference) and Appendix D (ILIM-7 Module Icon Reference).

TERMINALS

As described in Chapter 7 (Icon-Based Programming), the icon Terminals are as follows:



CONFIGURING ICONS

Icon configuration entails selection of various icon operational parameters such as names, Input ranges, sampling rates, etc and is simply done through dialog boxes associated with each icon.

To configure an icon that has been placed on the workspace, double-click on the graphic and an icon Configuration Dialog box will appear. Various standard Windows techniques are used to select the different parameters within the dialog box, from text entry and editing to selection via radio buttons.

COMPARATOR ICON

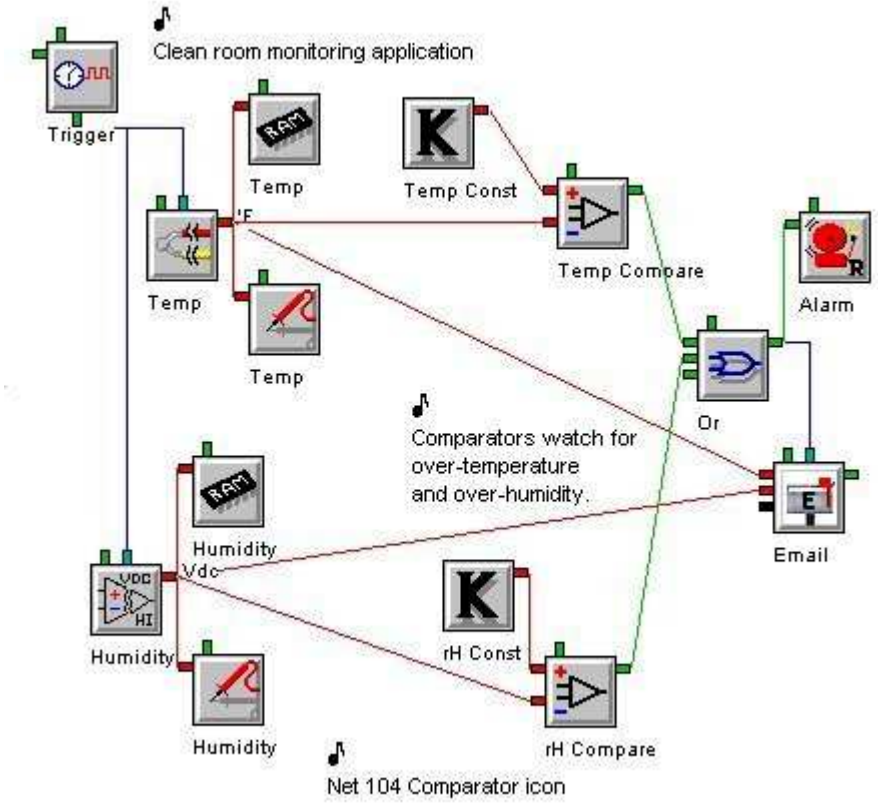
FUNCTION:

The Comparator icon performs a comparison between its X and Y Inputs. It outputs a Logic (High/Low) signal depending on the result of the comparison. If the X Input is greater than the Y Input, the Output is High. If the X Input is less then the Y Input, the Output is Low.

EXAMPLE APPLICATION PROGRAM NET:

This program in designed to monitor the temperature and relative humidity of a clean room. A thermocouple is used for the temperature monitoring and a probe with a DC voltage Output for humidity.

Each input is sampled at the same rate. The humidity conversion to %rH takes place in the Vdc Input icon. The Vdc Input dialog box offers a Generate Equation function under the Edit button. Each signal is then sent to a Memory and Probe icon as well as a Comparator icon that compares the measured value with a constant value entered into Constant icon. When the measured value (i.e. Temp) exceeds the Constant value (Temp Const), the Comparator Output (Temp Compare) goes High. This Logic signal is directed through an OR gate which allows either an over-temperature or over-humidity condition to initiate an alarm email. The measured values are embedded into the Email and a visual alarm is also executed via the Relay Output labeled Alarm.



CONNECTION TERMINALS:

Inputs: Analog Data

Two Data type Inputs are required for operation.

Enable: Logic Control

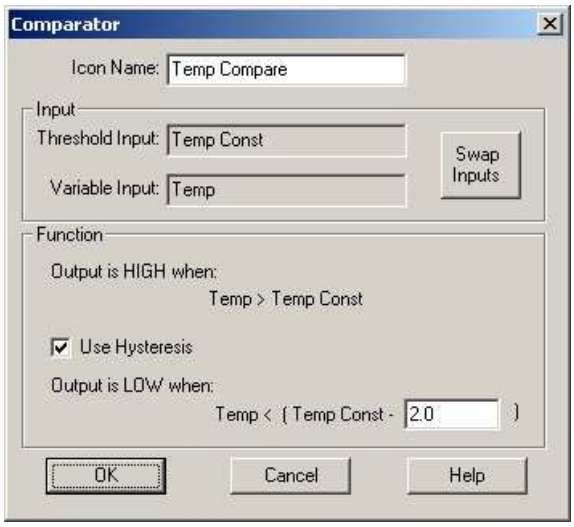
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Threshold Input:

Reflects the name of the icon (i.e. Temp Const) connected to this icon's + Input Terminal.

This is usually a constant, representing a boundary such as the setpoint.

Variable Input:

Reflects the name (i.e. Temp) of the icon connected to this icon's - Input Terminal. This is normally connected to the value being monitored.

Swap Inputs:

Clicking on the ***SWAP*** button swaps the Threshold and Variable Input connections. This change is reflected in the Input Name boxes as well as in the actual Program Net where the connections are redrawn.

Use Hysteresis:

When this is selected, the text box for entering the Hysteresis value appears. If the Hysteresis box is checked, an additional line is displayed with a text box for entry of hysteresis (i.e. dead-band) which is then included in the comparison function.

As shown, a Hysteresis of 2.0 degrees has been specified. In this case, when the temperature rises to equal or greater than TempConst, the Output will go HIGH. It will stay HIGH while it is above Temp Const, and will remain HIGH until the temperature drops two degrees below Temp Const at which time the Output will go LOW. Hysteresis is commonly used to prevent oscillation due to quick dynamic system response and/or signal fluctuations and noise/jitter.

Variable < (Threshold - _____)

This is the Hysteresis value.

CONDITIONAL LCD MESSAGE (LCD STATUS) ICON

FUNCTION:

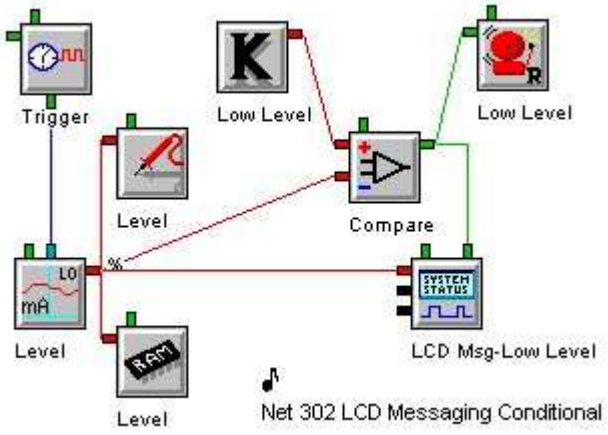
User-programmed messages can be displayed on the LCD (Liquid Crystal Display) on the front panel of the Logger System Base. When its Select Input is HIGH, this icon will add a *Status* type of message to the list of Active Messages that are displayed on the LCD screen of the Logger and on the Status dialog of HyperWare-II. As soon as the Select State goes LOW, the message will be removed from the list. This message can embed the current value of any Data Input on each of its three lines.

> **Note:** The list of Active Messages can be reviewed via the Logger front panel Next / Select buttons menu *Active Messages* or via a *Status Query* from within the Communication Window.

EXAMPLE APPLICATION PROGRAM NET:

A chemical manufacturer wants to monitor tanks levels of a finished product and be signaled when a low level of product is reached. A 4-20mA transducer is monitoring the product level via the milliAmp Input on the IntelliLogger. The mA Input is sampled once per second and the scaling of 0 -100 percent also takes place in the Input icon. When the level is less than the value set in the Constant icon (Low Level) the Compare icon Output goes HIGH. This causes the relay to close for an alarm and at the same time displays a message on the LCD indicating the current level as percentage full.

The message is displayed in the Active Message area on the LCD, with the embedded percentage updated each second. This continues to be displayed until Level rises above the Low Level, making Compare force the LCD icon's Select signal Low.



CONNECTION TERMINALS:

Inputs: Analog or Logic Data

Each of these three Inputs can be connected to either data type, or left unconnected.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Select: Logic Control

Unlike the Trigger Input, the Control Input is state-driven. As long as the icon is enabled and this Input signal is HIGH, the icon will embed the data Inputs and Output the message.

> **Note:** Hardware Output (to LCD display) only. No Output terminal is shown on icon for Program Net connections.

CONFIGURATION DIALOG:

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input 1 Name:

Reflects the name (i.e. Level) of the icon connected to this icon's upper Input Terminal. If this optional connection is empty, it will be labeled as Unconnected.

Input 2 Name:

Reflects the name of the icon connected to this icon's middle Input Terminal. If this optional connection is empty, it will be labeled as Unconnected.

Input 3 Name:

Reflects the name of the icon connected to this icon's lower Input Terminal. If this optional connection is empty, it will be labeled as Unconnected.

Message:

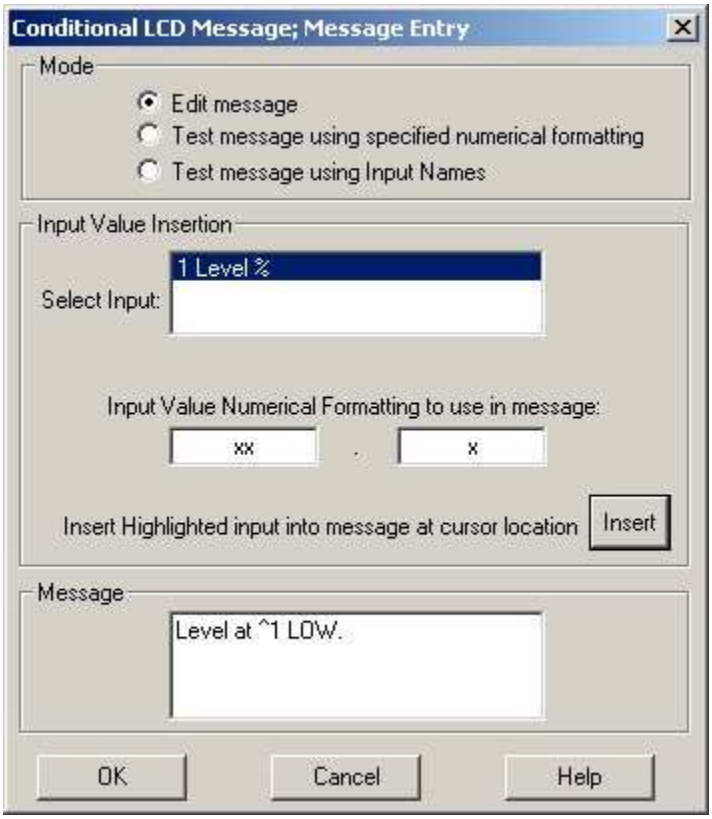
This displays a summary of the actual message. To edit the message, click on the ***Edit Message*** button, which is display the Edit Message Dialog, described below.

> **Note:** inserted input values will be displayed here as formatting keys, such as "##.#" or "^1".

Edit Message Dialog:

The Edit Message Dialog allows entry and formatting of the custom message for this icon. Each message can consist of up to three lines of text.

Because the message can be displayed on the LCD, a maximum of 20 characters per line is permitted.



Mode:

While editing this icon, Mode selection determines how text insertions will be displayed in the message window at the bottom of the dialog, providing a kind of preview function.

The formatting applied to Input Value Insertion entries (see below) affect the spacing, and therefore layout of the text when displayed on the LCD in these various display modes.

Message:

The text of the message is entered here, when 'Edit message' mode is selected.

To insert the values of inputs that are connected to this icon into a message, locate the cursor at the appropriate location within the message text, then highlight the desired Input from the *Select Input* list, and click on the ***Insert*** button. When each reference to an input value is added, it is assigned the currently specified Numerical Formatting (see below).

Special formatting keys are used to indicate each Input Value. These formatting keys are in the form of a caret (^) followed by the input number. For example, as shown above, the Input Value for Level would be represented as ^1 (because 'Level' is connected to input 1).

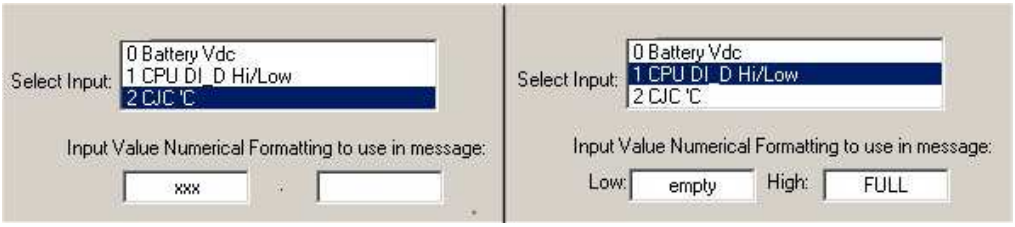
A limitation of these text messages is that only one embedded input value per line is permitted.

Select Input:

The input list displays the inputs connected to this icon whose input values are available for insertion into the message. The first column shown in the list is the Input number, the second column is the input's Name, and the final column is that Input's Units Text.

Input Value Numerical Formatting:

Values that are inserted into the text message can be formatted as decimal (floating-point) numbers, whole integers, or in the case of Logic Data, as text.



When working with Logic Data, you must enter text for both HIGH and LOW conditions. Each description can be up to 11 characters in length.

Decimal and integer numbers are also restricted to 11 characters, including the decimal point, if one is present.

In the examples above, CJC will be displayed as a whole integer, and for CPU_DI_D, either "empty" or "FULL" will be inserted into the message as applicable at the time.

> **Note**: be sure to allocate the maximum expected digits to the left of the decimal point, or the end of the line may be truncated.

CONSTANT ICON

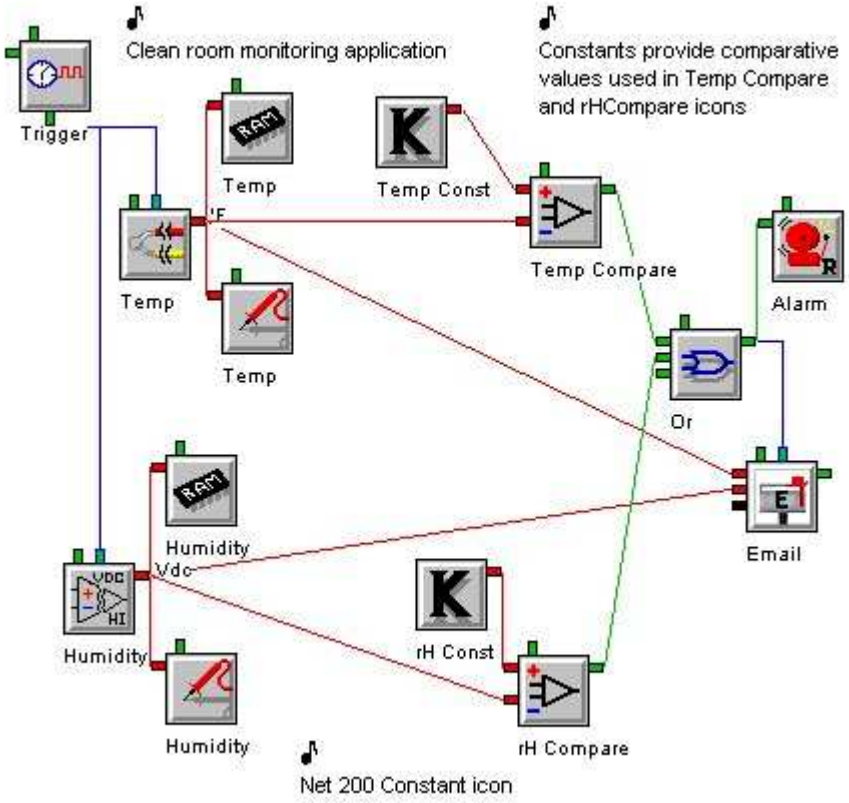
FUNCTION:

The Constant icon represents a fixed user-defined value. A typical application for the Constant is as a threshold for use with the Comparator icon as shown below.

EXAMPLE APPLICATION PROGRAM NET:

This program in designed to monitor the temperature and relative humidity of a clean room. A thermocouple is used for the temperature monitoring and a probe with a DC voltage Output for humidity.

Each of the Input icons is sampled at the same rate. The humidity conversion to %rH takes place in the Vdc Input icon. The Vdc Input dialog box offers a Generate Equation function under the Edit button. Each signal is then sent to a Memory and Probe icon as well as a Comparator icon that compares the measured value with a constant value entered into Constant icon. When the measured value (i.e. Temp) exceeds the Constant value (Temp Const), the Comparator Output (Temp Compare) goes High. This Logic signal is directed through an OR gate which allows either an over-temperature or over-humidity condition to initiate an alarm email. The measured values are embedded into the Email and a visual alarm is also executed via the Relay Output labeled Alarm.



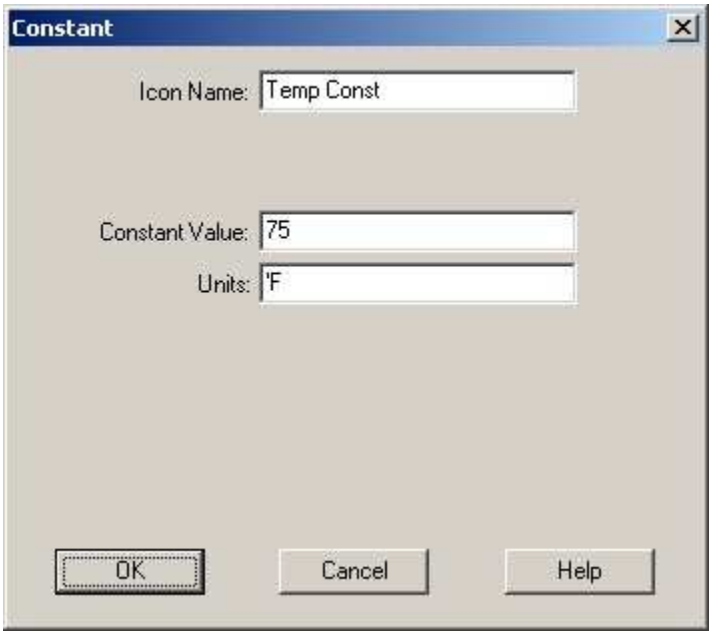
CONNECTION TERMINALS:

> **Note**: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Output: Analog Data

This is a fixed user defined value.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Constant Value:

A user-defined constant value is entered in this text box.

Units:

Provides a text box for user entry of a Units label that will be shown at the Output of this icon.

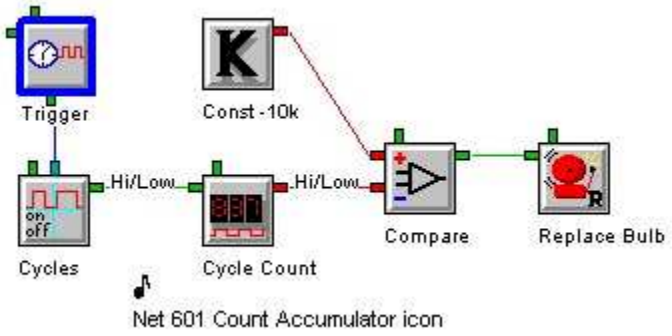
COUNTER ICON

FUNCTION:

The Count Accumulator icon is a software counter that can be used within a Program Net to count up to a user-defined count value, then output the count with a timestamp. After outputting the count, the Count Accumulator icon clears the counter and starts counting up again.

EXAMPLE APPLICATION PROGRAM NET:

As part of a research project a refrigerator manufacturer monitors the number of times the refrigerator door is opened in order to determine when the bulb should be replaced. They estimate that after 10000 open/close cycles that the bulb is nearing the end of its' life and replacement is required. The Digital Input sends a pulse each time the door is opened, which is counted in the Cycle Count Accumulator. Upon reaching the used defined level of 10000 the output value is sent to the Comparator, which compares against the 10000 Constant. Once this value is exceeded, the Comparator Icon's output will go HIGH, energizing the Relay icon.



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

Processing of icon is allowed:

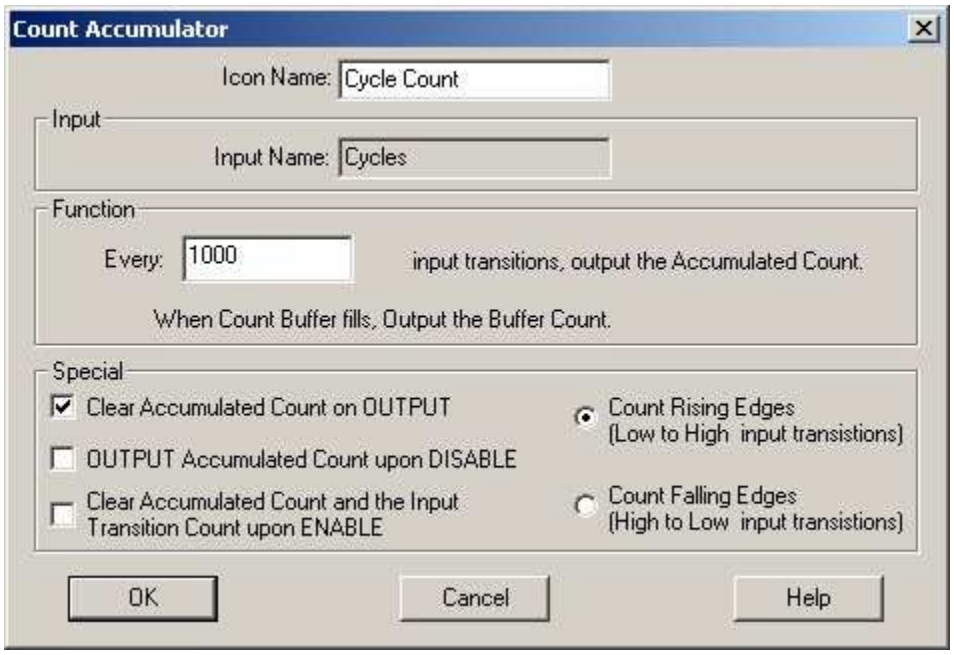
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

The accumulated count is output.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

Reflects the name of the icon connected to this icon's Input Terminal.

Every ____ input transitions, output the Accumulated Count:

A text entry box is provided for the number of transitions to accumulate. When the number of transitions received on the Up Counter's Input equals this user supplied value, the value is passed to the Output and the count resumes again at zero.

Clear Accumulated Count on Output:

Check this box to force the Count Value to be reset to 0 after Output. If this box is not checked, the icon will not reset this Count Value to zero, so that subsequent increments will continue counting from the current value.

Output Accumulated Count upon Disable:

Check this box to force an output of the accumulated Count at any time that the icon is disabled. If this box is not checked, upon receipt of a disable signal, the Counting function will be momentarily suspended until the icon is re-enabled and no in-process value will be output.

For example, if a Count is to be output after 100 samples have been received but only 60 have been received when the icon is disabled, the 60 sample Count total will be output and the counting function will be suspended until re-enabled. Upon re-enable, counting will continue and after 40 more samples are received, the

100 sample Count Total will be output (unless the following check box is checked).

Clear Accumulated Count and the Input Transition Count upon Enable:

Check this box to force a reset of the accumulated Count Total as well as the Sample count used for calculation upon receipt of an Enable signal.

If this box is not checked, upon receipt of an Enable signal, counting calculation will proceed from its suspended state (that it entered when the icon was disabled).

Count Rising Edges:

The Timed Counter increments its accumulated count when its Input changes state. Use this option to specify that LOW to HIGH transitions (edges) are to be counted.

Count Falling Edges:

The Timed Counter increments its accumulated count when its Input changes state. Use this option to specify that HIGH to LOW transitions (edges) are to be counted.

CUSTOM WEBPAGE (WEB) ICON

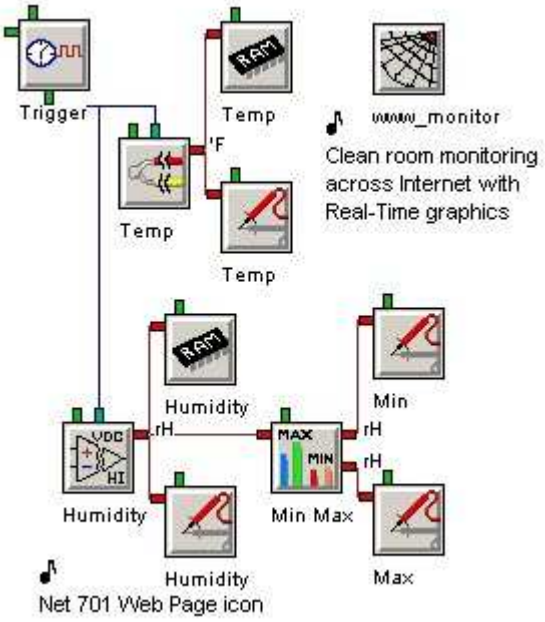
FUNCTION:

This icon provides access to the Web Page Design Window. Each Webpage icon contains the information needed to display one entire webpage in the Real-Time Trending Window, or remotely in the GreenWater application. For detailed explanation of how to design and view Custom Web Pages, refer to Chapter 9.

EXAMPLE APPLICATION PROGRAM NET:

This program in designed to monitor the temperature and relative humidity of a clean room. A thermocouple is used for the temperature monitoring, and a probe with a DC voltage output is used for humidity. The conversion to relative humidity (rH) uses the Equation Generator within the Low Voltage Input (Humidity) icon. Each signal is then sent to a Memory and Probe icon. The Humidity also goes to a Min/Max icon that has Probe Point icons for the minimum and maximum.

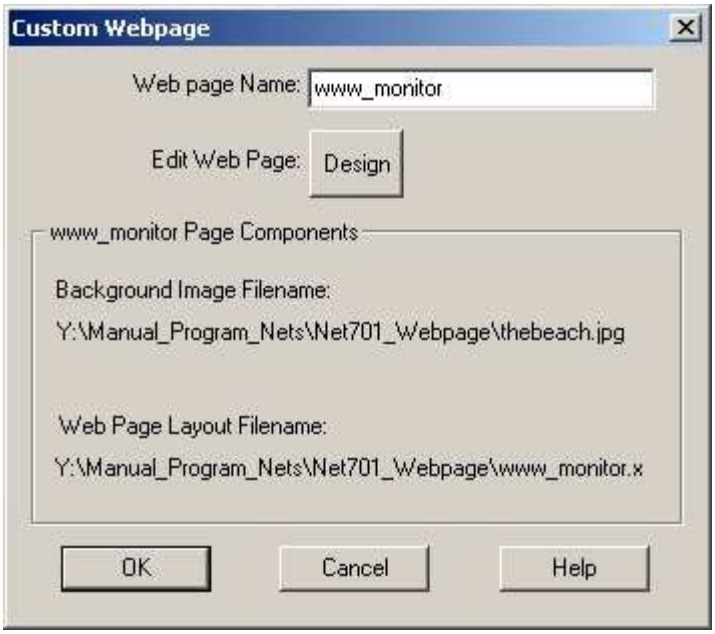
A web page icon was added to provide graphical Real-Time monitoring across the Internet.



CONNECTION TERMINALS:

Note: There are NO Terminals shown for icon connections in the Program Net for the Webpage icon.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Edit Web Page:

Clicking on the Design button will display the Web Page Design Window. For more information on this, see Chapter 9 (Custom Web Pages).

Background Image Filename:

This is the name of the image file specified as the page background, if one is assigned.

Web Page Layout Filename:

This is the name of the XML file containing design layout information used to display this Custom Web Page.

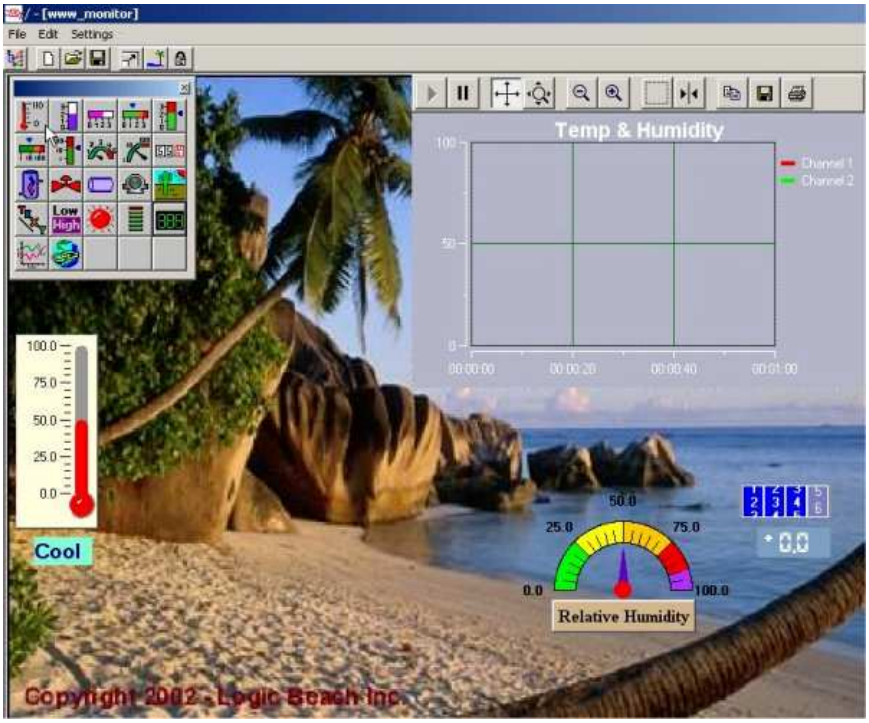


Figure 14-1; Example Custom Web Page

RAM (MEMORY ICON)

FUNCTION:

The Memory icon represents data memory within the Logger System Base. This could be either internal memory or a Compact Flash (CF) memory card, if installed.

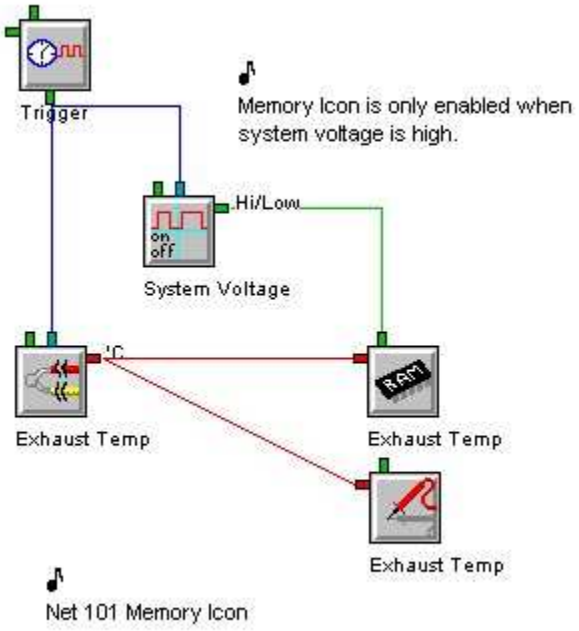
The Units that will be stored with the recorded values are taken from the Output of the icon that is connected to the RAM icon Input.

> **Note:** RAM icons accumulate data in memory, but cannot be used for Real-Time Trending or with the GreenWater™ application.

EXAMPLE APPLICATION PROGRAM NET:

This is a simple program that samples a thermocouple in the exhaust stream of a vehicle. Data storage is only required when the vehicle is running. The data logger is always enabled and samples the exhaust temperature thermocouple once every 10 seconds, even if the vehicle is off. The Digital (Event) Input labeled System Voltage detects the vehicle voltage and outputs a HIGH signal enabling the RAM icon and allowing the data to be stored.

Typically programs do not use the Enable Input of the RAM icon. Eliminating the connection to its Enable Input would allow data to be stored whenever the logger is enabled.



CONNECTION TERMINALS:

Input: Logic or Analog Data.

The Input Terminal will accept either data type.

Enable: Logic Control

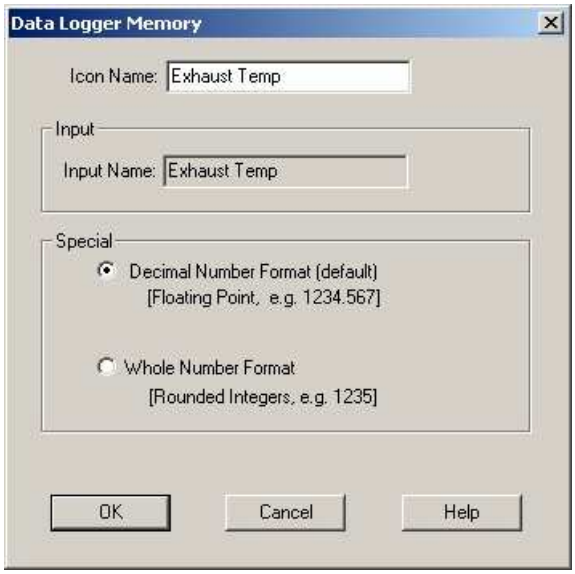
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Output to memory only. There are no Output terminals shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. By default, the RAM icon will automatically take the name of its Input icon, but it can then be changed to a unique name if needed.

Input Name:

Reflects the name (i.e. Exhaust Temp) of the icon connected to this icon's Input Terminal.

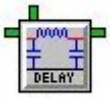
Decimal Number Format:

Selecting this option will display the stored data in floating point format. This includes both integer and decimal components (XXX.XXX).

Whole Number Format:

Selecting this option will display the data as rounded to Signed Integer format. This includes only the digits to the left of the decimal point (XXXXX.). For example, 123.4 would be shown as 123, but 4321.5 would be displayed as 4322.

DELAY ICON



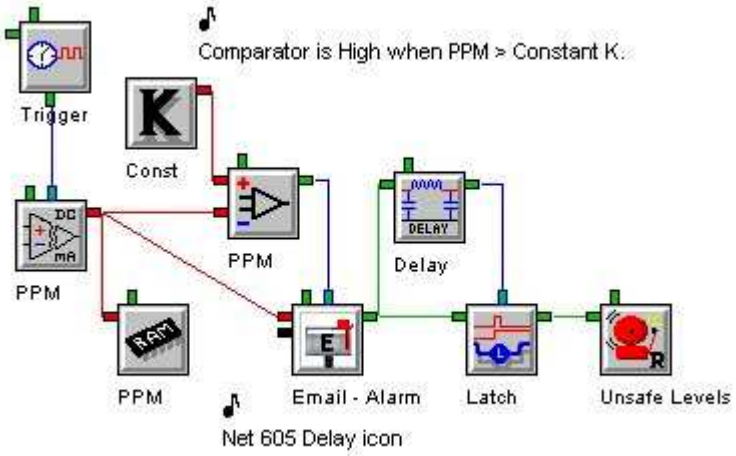
FUNCTION:

The Delay icon can be used to delay or "stretch" logic pulses. When a transition is received at its Input, the icon waits a User-specified period of time before applying the same transition to its Output. Separate delay times can be set for LOW to HIGH and for HIGH to LOW transitions. To delay a Trigger Pulse, both times should be set to equal values.

EXAMPLE APPLICATION PROGRAM NET:

This program is designed to monitor and record the air quality in an Expanded Polystyrene factory. If the air quality is poor (1000 PPM or greater) an email is generated to warn Operations. The 4-20mA input is sampled at a rate of once per minute and the milliAmps to PPM conversion takes place in the DCmA input icon. The signal is sent directly to memory and also to a Comparator icon for alarming.

If the output of the Comparator goes High then an emailed text message is sent to the operator's cell phone. If an error occurs when sending the message, the Email icon output goes High. The Delay icon delays the High signal for 10 minutes to allow for operator intervention, then using the Latch icon, latches on the Unsafe Levels relay until reset.



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

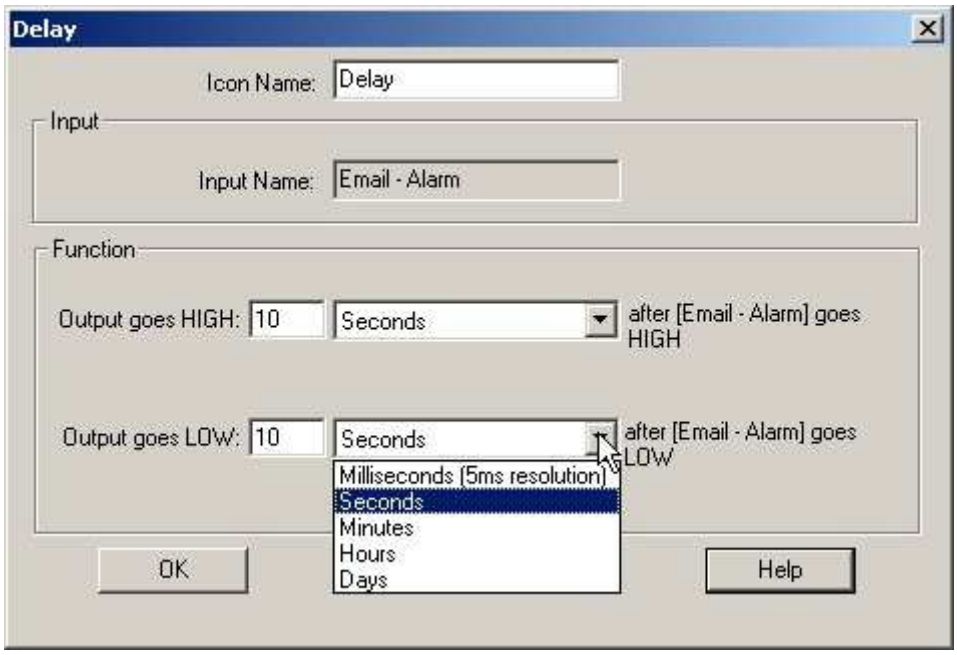
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

Reflects the name of the icon connected to this icon's Input Terminal.

Output goes High:

Specifies the delay for LOW to HIGH transitions. A text box is provided for entry of a number. The Units (milliseconds, seconds, minutes, hours or days) can be selected from the drop down list.

Output goes Low:

Specifies the delay for HIGH to LOW transitions. A text box is provided for User entry of a number. The Units (milliseconds, seconds, minutes, hours or days) can be selected from the drop down list.

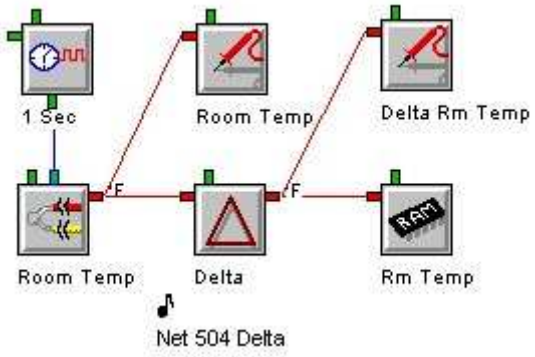
DELTA ICON

FUNCTION:

The Delta icon provides a special data processing function that can be used in a Program Net to drastically reduce the number of data samples required to profile an analog signal. The Delta icon only passes data from Input to Output when the Input signal differs from the previous sample by more than a preset amount, i.e. the `delta' value. When logging data that has periods of relatively stable values mixed with occasional dynamic fluctuations, the Delta icon can reduce the amount of data samples required to profile the curve with a minimum of accuracy compromise.

EXAMPLE APPLICATION PROGRAM NET:

This demonstration Program Net illustrates how the Delta icon can track the more frequently sampled Input. The Delta icon is configured to pass data only if the data changes by more than one and a half degrees F, or once a minute when it is very stable. By watching both Probe Point icons, the ability of the Delta icon to track is apparent. Meanwhile memory space is being conserved if the data do not change by more than 1½ degrees.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

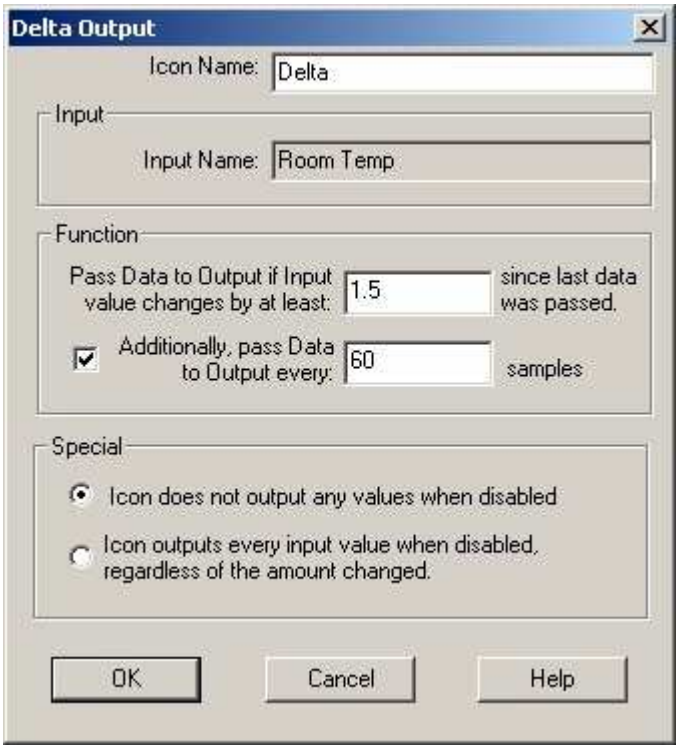
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

The Delta icon updates its Output when the Input has changed in magnitude by a user-defined `delta' amount in comparison to the previous sample.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's Input Terminal.

Pass Data to Output if Input value changes by at least ____ since last data was passed.

A text box is provided to allow the User to specify the `Delta' value. For example, if data is to be passed to the output whenever it changes by more than +/-1½ degrees, then enter the value of 1.5

Additionally, pass Data to Output every ___ samples.

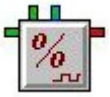
If this box is checked, a value will be sent to the output periodically regardless of whether the delta value has been exceeded or not.

Special:

When the Delta icon is *Disabled*, it offers an all or nothing proposition. If the Upper radio button is selected, there will be no Output while the icon is disabled.

If the Lower radio button is selected, every Input value is passed through the Output while the icon is disabled.

DUTY CYCLE ICON



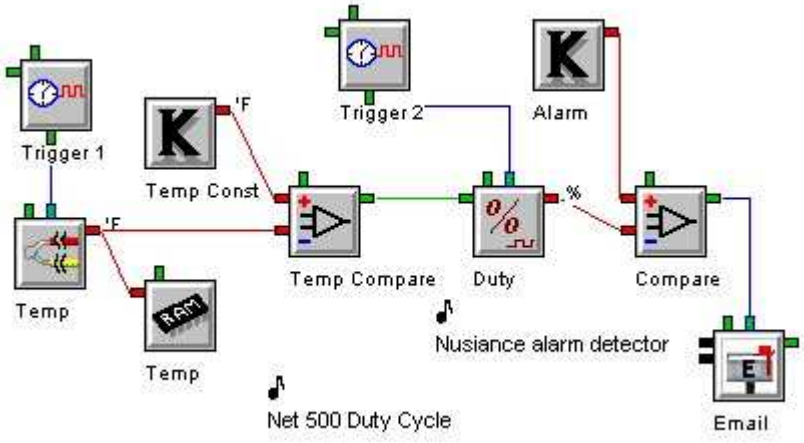
FUNCTION:

Calculates the accumulated amount of time that the Input signal is HIGH or LOW, during a User-defined time period. At the end of each period the Duty Cycle icon will output the accumulated time its Input was in the selected state. It is to be used with *Logic* Input signals, connected to the *Logic* Output of an upstream icon (e.g. an Event icon).

NOTE: For integration of *Analog* type signals, refer to the Integral icon.

EXAMPLE APPLICATION PROGRAM NET:

A simple temperature monitoring application needed a way to prevent nuisance alarms. (Using the Hysteresis in Temp Compare is another method) The Temp Compare Comparator goes High when the measured temperature exceeds the value in Constant K. The Duty Cycle function uses the High time from Temp Compare to calculate the On Duty Cycle for the length of time in Sample Rate icon Trigger 2. The analog value Output from the Duty Cycle icon is sent to another Comparator that requires the Duty Cycle value to be greater than 80% to trigger the Email icon.



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

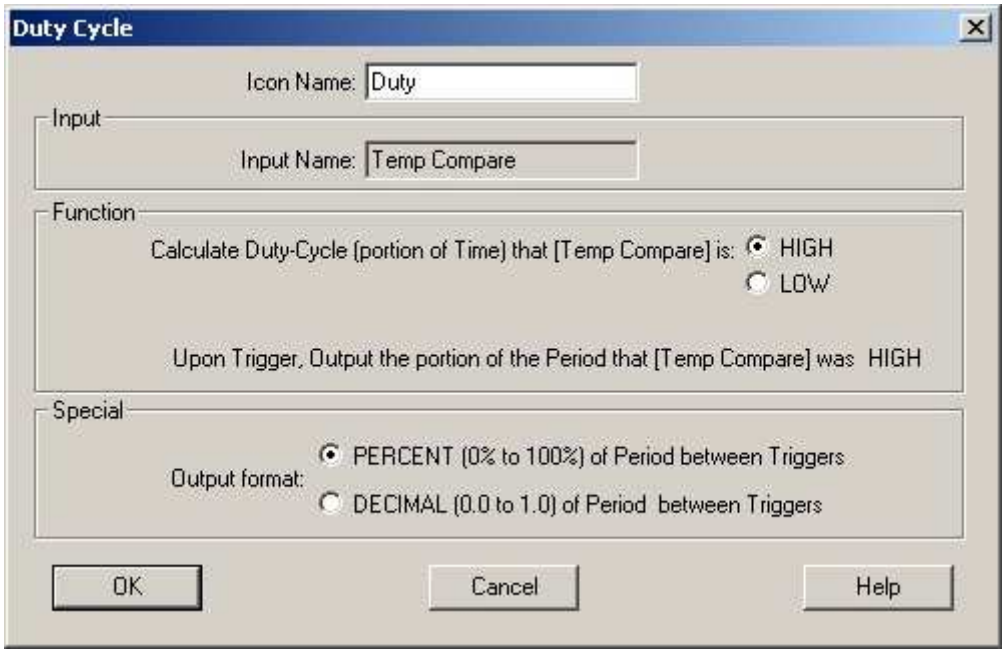
Trigger: Logic Control

Specifies the time period over which the Duty Cycle is calculated, if the icon is enabled.

Output: Logic Data

The Duty Cycle icon updates its Output after receiving a Trigger Pulse from the icon connected to its Trigger Input. The Output will be in Percent or Decimal format, depending on the User-specified Output format within the Configuration Dialog.

CONFIGURATION DIALOG:


Duty Cycle
Icon Name: Duty
Input
Input Name: Temp Compare
Function
Calculate Duty-Cycle (portion of Time) that [Temp Compare] is: HIGH
LOW
Upon Trigger, Output the portion of the Period that [Temp Compare] was HIGH
Special
Output format: PERCENT (0% to 100%) of Period between Triggers
DECIMAL (0.0 to 1.0) of Period between Triggers
OK
Cancel
Help

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This value reflects the name of the icon connected to this icon's Input Terminal.

Calculate Duty Cycle:

This is used to select whether the state of the Input is HIGH or LOW while accumulating time per Period.

Output Format:

Specify whether the Output value is to be formatted as:

PERCENT
A number from 0 to 100

DECIMAL
A number from 0.0 to 1.0

EMAIL ICON

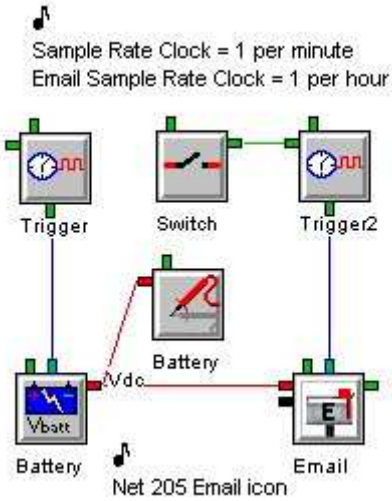
FUNCTION:

The Email icon sends an email message whenever its Trigger is pulsed LOW to HIGH. It can be used to send alarm notification, to relay status or to transmit data. There are two options for including data with the message. Readings from other icons can be embedded within the text of the message, or whole data files can be appended to the email as attachments. The Email icon will output a signal if it was not able to send an email for some reason.

EXAMPLE APPLICATION PROGRAM NET:

A new IntelliLogger owner wishes to test the email function of his data logger. He uses the Battery icon to measure logger system voltage and connects this to a Probe Point for Real-time Trending. He also connects it to the Input for the Email icon. He uses a different Sample Rate Clock, Trigger 2, for the Email icon. Now every pulse from Trigger 2 will cause an Email to be sent with the measured value from the Battery icon.

Trigger2 has a Standard Pulse Rate of 5 minutes, and an Alternate Pulse Rate of one hour. To expedite the test without getting swamped by emails, the User initially runs Trigger2 at 5-minute intervals. When the first few emails have been received, the User Remotely changes the Switch to activate Trigger2's Alternate Rate of 1-hour intervals, for an overnight test.



CONNECTION TERMINALS:

Inputs: Analog Data or Logic Data

Inputs to the Email icon are available to embed values into the text of the email message. Each Email Input Terminal can be connected to either data type, independent of the other Inputs. As an Input Terminal is connected, a new one will appear on the Email icon, up to a maximum of 24 Input Terminals.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is updated with the most recent Input values

Upon each Trigger Pulse, if the icon is enabled, the text of the Email message is updated by embedding the latest Input values, and then an Email is sent.

Output: Logic Data

The Email icon's Output goes HIGH if Logger detected an error while sending an Email. Some Email problems are not detectable by the Logger, such as when an SMTP server accepts the email, but then cannot resolve the *To:* address. If a problem is detected, check the following:

EMAIL TROUBLESHOOTING HINTS

Email icon:

TO: address is invalid (i.e. misspelled)

FROM: address is invalid, or is not recognized by the SMTP server

System Configuration:

These parameters are all set on Tabs of the System Configuration Dialog, in the Communication Window:

Ethernet is *Disabled* in the configuration (Communication Tab), so an ISP must be dialed to get a network connection and:

modem is also disabled (Communication Tab)

dial out to get a network connection is disabled (Communication Tab)

ISP phone number is missing or invalid (Modem Tab)

PPP username is missing or invalid (Modem Tab)

PPP password is missing or invalid (Modem Tab)

Ethernet is *Enabled* in the configuration (Communication Tab) and:

Server and/or port settings are missing or invalid (Network SMTP Tab)

Authentication setting is not correct (Network SMTP Tab)

Connection errors

Modem missing or powered off

Incorrect Modem configuration

Non-compatible Modem

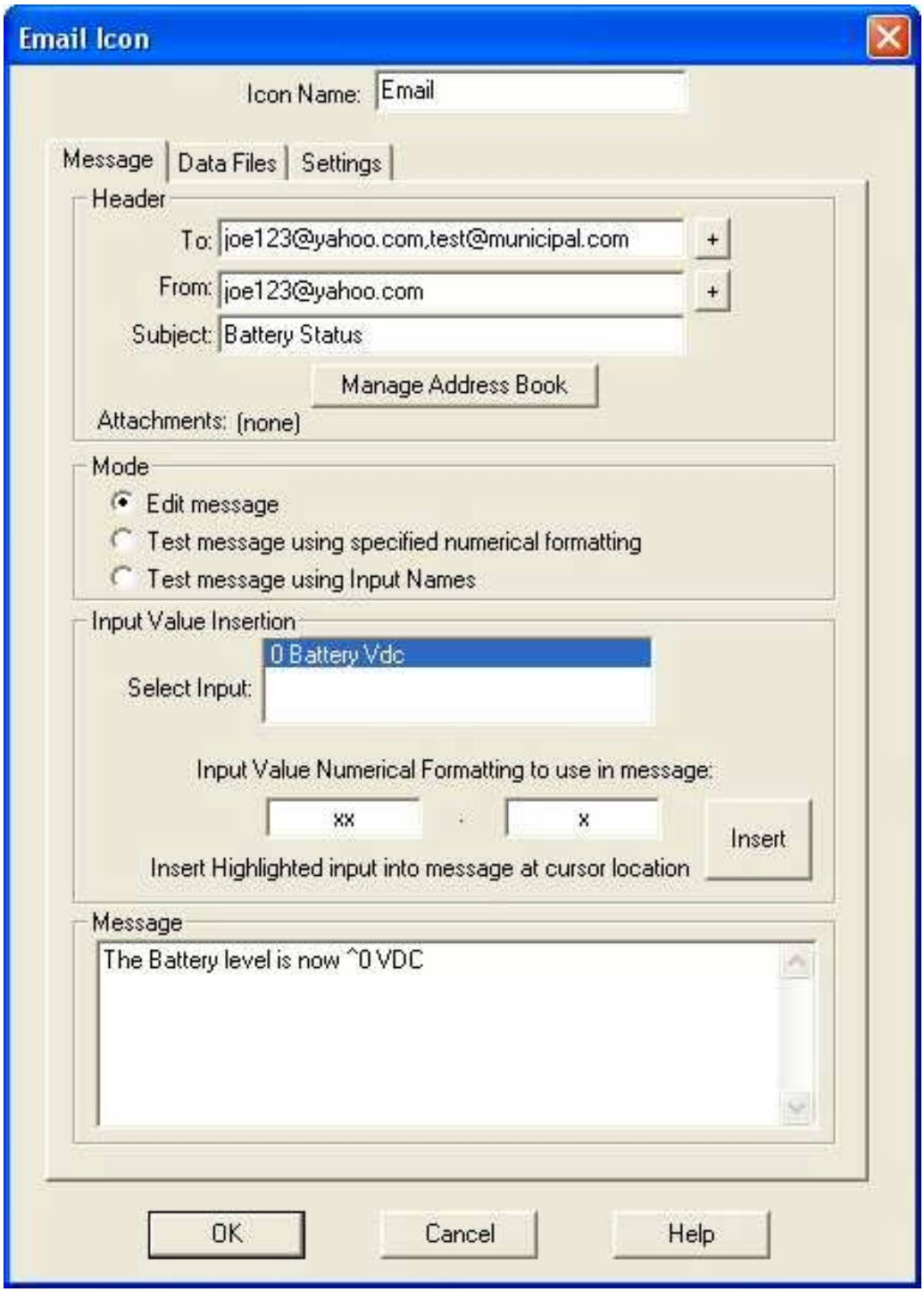
Busy signal

Internet Service Provider (ISP) server overburdened or down

Telephone Line failure

CONFIGURATION DIALOG:

Three tabs are used in the configuration of an Email icon.



CONFIGURATION DIALOG – MESSAGE TAB:

Everything needed to compile a simple email message with embedded data values is handled on this page.

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

To:

This is a list of one or more email addresses, separated by commas. These email addresses may be entered manually, or using the ***Address Book***.

From:

A valid Email address recognized by the SMTP server that has been specified in the *Network* tab of the *System Configuration* Dialog of the Communication Window.

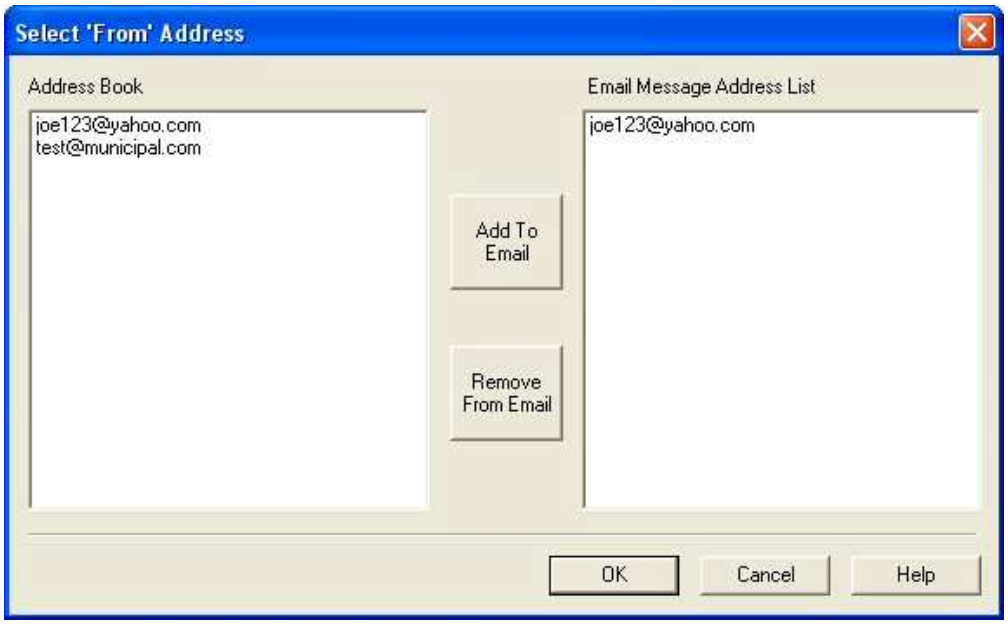
> **Note:** Internet email specifications sometimes refer to the "From:" address as the error reporting address. This means that this is the email address that all error messages generated by the email system, including returned emails, will be sent to.

Subject:

This is a brief descriptive subject for the message. This is a required field, and must not be left blank.

Inserting Addresses from the Address Book

Email addresses can be added from the global address book by clicking on the + button to the right of either the To or From fields. Once clicked, the Select Addresses dialog is shown:



Email addresses can be added to the selected field by highlighting them from the Address Book entries on the left, then clicking the "Add To Email" button.

To remove email addresses from the email message, highlight them on the right and then click the "Remove From Email" button.

Basically, whichever email addresses are in the list to the right when Ok is clicked will be copied into the current email field.

Mode:

While editing this icon, Mode selection determines how text insertions will be displayed in the message window at the bottom of the dialog, providing a kind of preview function.

The formatting applied to Input Value Insertion entries (see below) affect the spacing, and therefore layout of this text as shown in these various display modes.

Message:

The text of the message is entered here, when 'Edit message' mode is selected.

To insert the values of inputs that are connected to this icon into a message, locate the cursor at the appropriate location within the message text, then highlight the desired Input from the *Select Input* list, and click on the ***Insert*** button. When each reference to an input value is added, it is assigned the currently specified Numerical Formatting (see below).

Special formatting keys are used to indicate each Input Value. These formatting keys are in the form of a caret (^) followed by the input number. For example, as shown above, the Input Value for Battery would be represented as ^0 (because 'Battery' is connected to input 0).

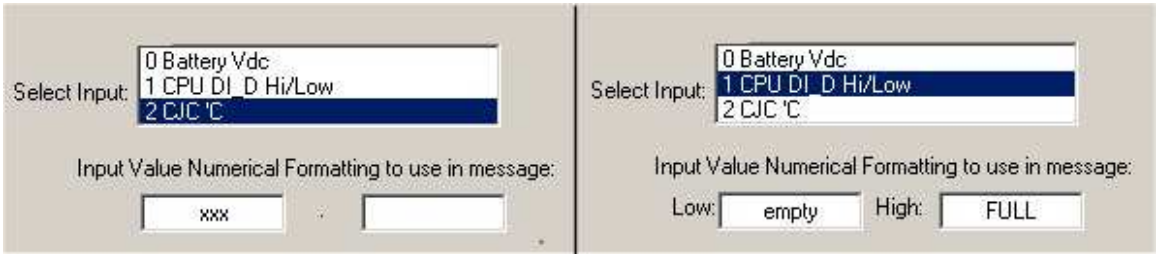
A limitation of these text messages is that only one embedded input value per line is permitted.

Select Input:

The input list displays the inputs connected to this icon whose input values are available for insertion into the message. The first column shown in the list is the Input number, the second column is the input's Name, and the final column is that Input's Units Text.

Input Value Numerical Formatting:

Values that are inserted into the text message can be formatted as decimal (floating-point) numbers, whole integers, or in the case of Logic Data, as text.



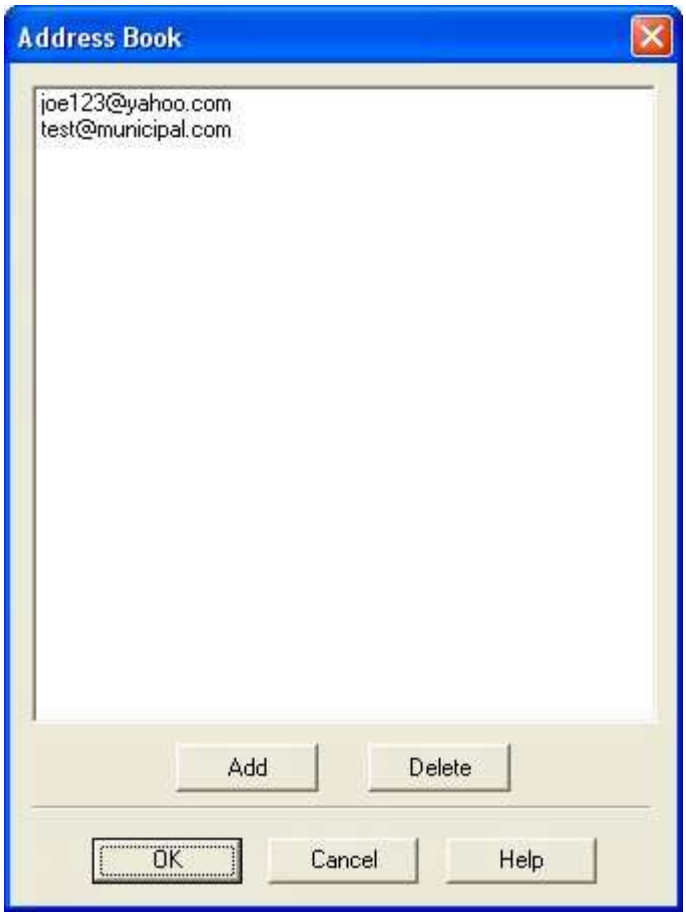
When working with Logic Data, you must enter text for both HIGH and LOW conditions. Each description can be up to 11 characters in length.

Decimal and integer numbers are also restricted to 11 characters, including the decimal point, if one is present.

In the examples above, CJC will be displayed as a whole integer, and for CPU_DI_D, either "empty" or "FULL" will be inserted into the message as applicable at the time.

Address Book:

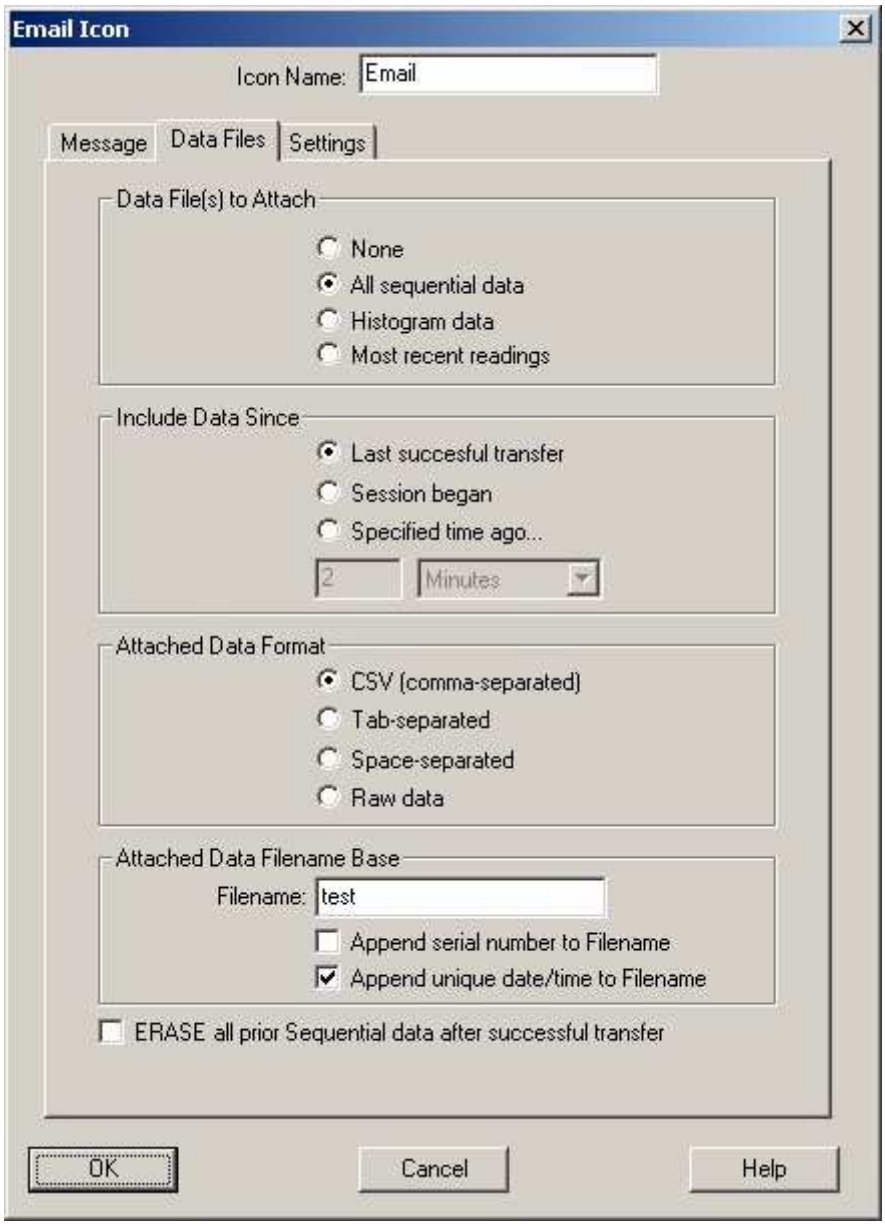
Clicking on the Address Book button displays the global email address book, where email commonly used email addresses can be added or removed. This address book is stored on the PC and is therefore not specific to one Program Net.



CONFIGURATION DIALOG - DATA FILE TAB:

This Tab is required when there will be a data file attached to the message. This can be used to optionally select the Time Span, Data Type and Format of the data to be transmitted, as well as specifying the name of the data file(s).

An additional option is available to instruct the Logger to clear the transmitted data from Logger memory after the data file has been successfully sent.



Data File(s) to Attach:

This allows the selection of the Data Type to be included in the file.

NONE:
This is the default for Email, meaning no data file will be attached.

ALL SEQUENTIAL DATA:
Select this to send data from all of the RAM icons in the Program Net.

HISTOGRAM DATA:
Select this to send data logged to memory from Histogram icons.

MOST RECENT READINGS:
Select this to send the single most recent reading for each Probe Point icon in the Program Net. This does not include data from any RAM icons.

Include Data Since:

Selects the Time Span of data to be included in the file.

LAST SUCCESSFUL TRANSFER:
Only sends data values that were not previously sent.

SESSION BEGAN:
This option sends all data since the beginning of the current session, when the Logger was enabled, regardless of whether it was previously sent or not.

SPECIFIED TIME AGO:
This allows the selection of data from a user-defined amount of time just prior to the Trigger event. A text box is provided for entry of a number. The Units (seconds, minutes, hours or days) can then be selected from the drop down list.

Attached Data Format:

This determines the format of the data in the files being sent. With the exception of Raw Data, each format translates the data into a human-readable spreadsheet-type format, with rows representing each Net Scan timestamp, and Columns representing each RAM icon.

CSV:
This option specifies column values will be separated by Commas (Comma Separated Values).

TAB-SEPARATED:
This option specifies column values will be separated by Tab characters.

SPACE-SEPARATED:
This option specifies column values will be separated by spaces, and filled to align columns on 35 character boundaries.

RAW DATA:
Data files will be sent in unformatted XID format, which is the raw format used by the logger and contains data as well as checksum information. This format is not human-readable, however is the most compact format and may be later used by HyperWare for additional processing, such as plotting.

Attached Data Filename Base:

This specifies the naming convention used for data files being sent.

FILENAME:
This value assigns a name to the file being sent.

APPEND SERIAL NUMBER:
Selecting this option will append the logger serial number to the Filename, allowing it to be distinguished from files sent from different Loggers.

APPEND DATE/TIME:
When checked, this option adds the date and time value to the filenames being sent, so that unique filenames are created to prevent overwriting earlier files.

Leave this option unchecked to replace old files with the latest ones on the computer the files are being sent to, if required.

Erase:

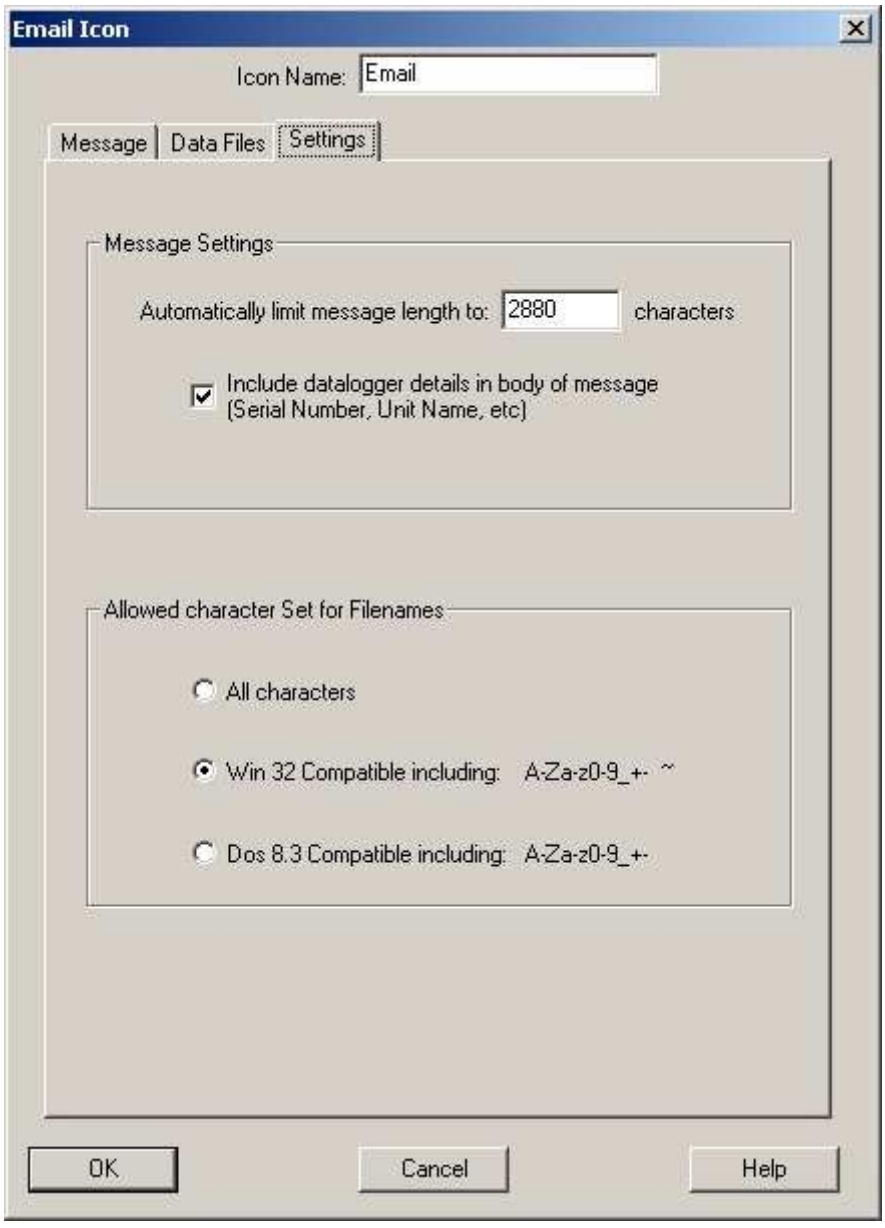
When this option is checked, data that has been successfully transferred will be erased from the Logger. If the transmission failed, this data will remain intact.

Leave this option unchecked to keep all data in the Logger.

CONFIGURATION DIALOG – SETTINGS TAB:

This page is different from the others because it does not affect anything that happens while the logger is running.

Parameters specified on this page are only concerned with things that happen during the editing of this icon, such as warning messages for the User.



Automatically limit message length to _____ characters:

This can usually be left at the full 2880, unless the message is being sent as text messaging to a cell phone. If the cell phone's provider has a smaller limit, this may be entered. Changing this setting does not affect the Logger, but will provide automatic warnings while editing the Email icon if the message becomes too long.

Include datalogger details:

Check this box to automatically prepend distinguishing information to the message as it is sent out. This includes the Date and Time, Serial Number, Unit ID and Unit Name of the Logger.

Allowed Character Set for Filenames:

This affects only warning messages generated while editing this icon. If a Data File is being attached, this will ensure that the filename matches the restrictions of the target system. For example, if the Email is going to a machine that only caters for short file names, select *DOS 8.3.*

FILE TRANSFER PROTOCOL (FTP) ICON

FUNCTION:

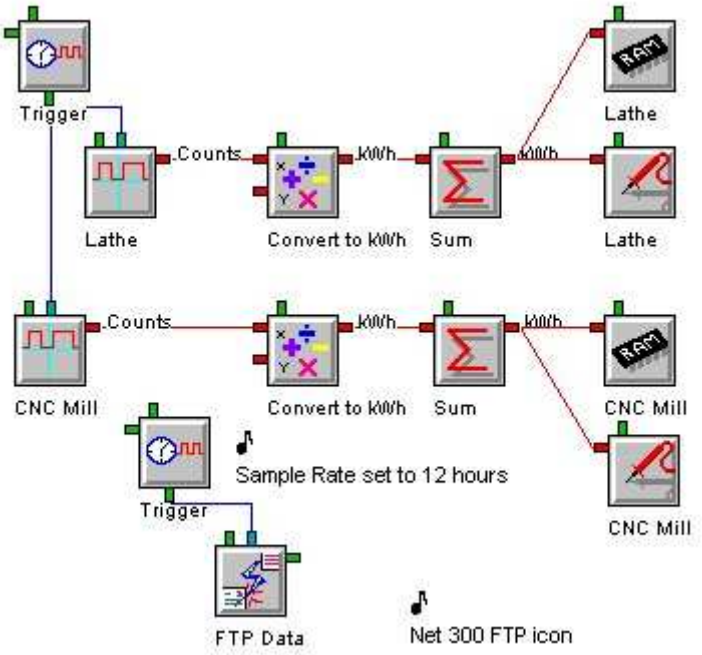
The FTP icon transmits data files to a designated server whenever its Trigger is pulsed. It will output a signal if it was not able to transmit for some reason.

EXAMPLE APPLICATION PROGRAM NET:

A machine shop is using a networked Logger to collect power consumption data on two machines, a lathe and a CNC mill. At the end of a 12-hour period, the data logger automatically transfers the recorded data to a central PC for analysis.

The three-phase 480VAC kWh sensors, monitoring the machinery, output a pulse equal to a programmable number of kilowatt-hours. The Math icon converts the number of pulses into the correct kWh value and the Summation icon generates the total of every 10 samples. The values are then sent to RAM and Probe Point icons.

Another Sample Rate Clock connected to the FTP icon is set for 12 hours. Every 12 hours the Trigger pulse will execute an FTP data transfer to the FTP server specified in the FTP icon dialog box with data from the previous 12 hours.



CONNECTION TERMINALS:

Note: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Data files are sent via FTP to the designated server upon each Trigger Pulse, if the icon is enabled.

Output: Logic Data

The Output will go HIGH if the Logger detects an error while sending FTP data. If an error is detected, check the following:

FTP TROUBLESHOOTING HINTS

The following are some reasons FTP transfers may fail:

1. Incorrect user name and password.

Verify the user can use the same name/password and successfully transfer data with a Windows FTP client. This has been an issue with cell modem systems, which may use different names/passwords to connect to the modem for configuration, to connect for Hyperware, and to connect to an FTP server. There has been at least one reported instance of a password change not "sticking" when made by a network support person.

2. Incorrect "FTP Destination Directory." Typical correct entries are:

/
/home
/<user>
/home/<user>
/<???>/<user>
.

where:
<user> is user account name or ID
<???> is some system-specific value which must be obtained from the user's IT support.

Typically the best source of the correct directory name is the user's IT support.

3. Selection of FTP "active" or "passive" mode.

"Active" mode should be tried first, then "Passive" mode. Ensure that failure causes (1) and (2) have been examined, usually by connecting with a Windows FTP application.

- Most Windows applications provide a means to select active vs. passive mode. Verify which (or both) work with the Windows application.

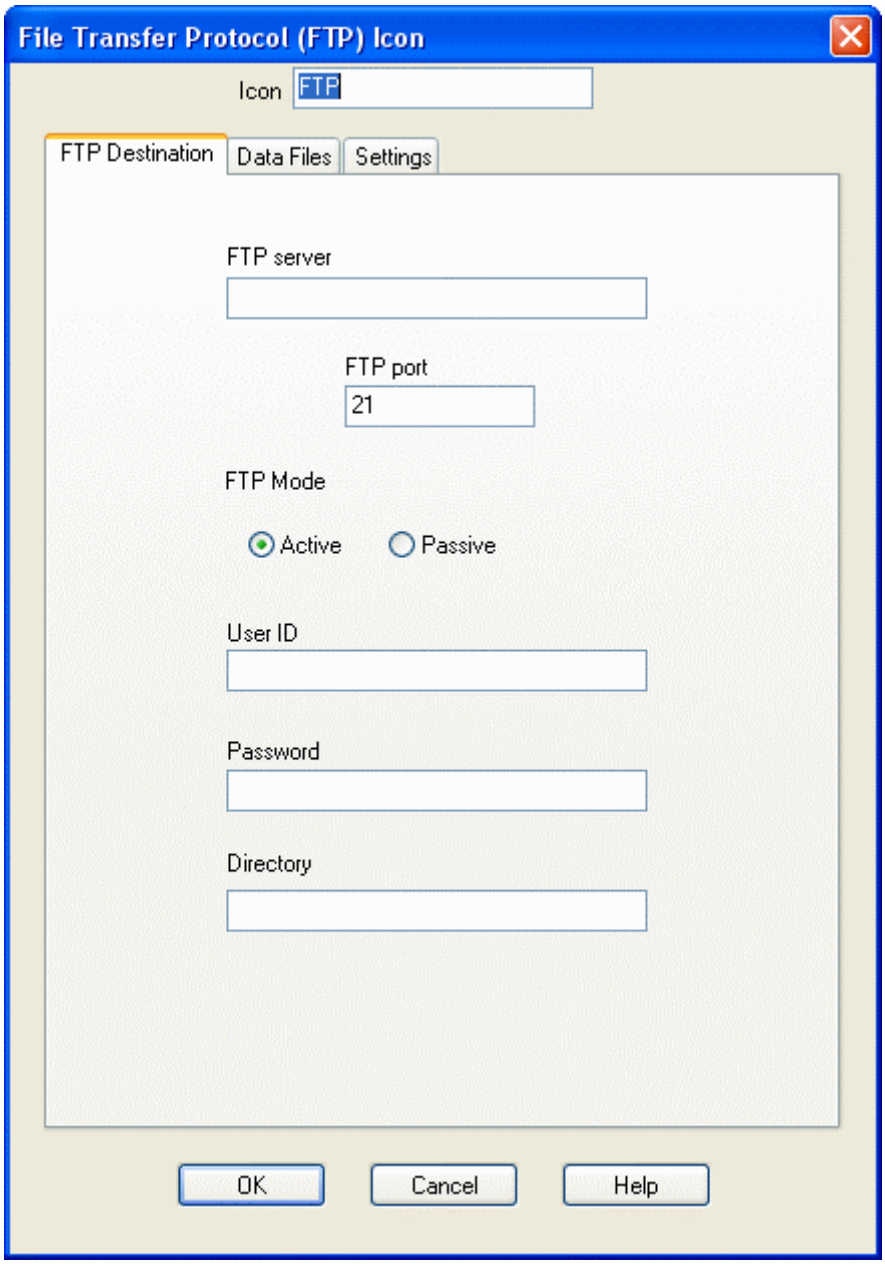
- Some FTP servers may require a different "FTP Destination Directory" for active vs. passive mode.

- Historically, active mode was more common. Passive mode is often used for web-based FTP transfers and is also used to provide a higher level of security.

- Ensure that Windows-based testing is done using the --exact-- same configuration as the logger configuration. Connecting to a server inside a corporate firewall via wired Ethernet may be different than using WiFi to a corporate access point which may be different from connecting to a public WiFi access point which may be different from connecting via an ISP which may be different from connecting via cellular modem.

CONFIGURATION DIALOG - FTP DESTINATION TAB:

This page defines connections to the target FTP server.



CONFIGURATION OPTIONS - FTP DESTINATION TAB:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

FTP server:

This is the name or IP address of the FTP server on the Internet or Network that will be used to send files to. Check with your System Administrator for the correct FTP server address.

FTP port:

The number of the port used by the server for FTP transfers (this is normally 21).

FTP Mode:

Selection of FTP "active" or "passive" mode. This should be set to match the settings of the FTP server the logger will be connecting to. "Active" mode should be tried first, then "Passive" mode. Historically, active mode has been more common. Passive mode is often used for web-based FTP transfers and is also sometimes used to provide a higher level of security.

User ID:

This is the user name with which to log in to the FTP server. Please check with the FTP server's System Administrator for username and password information.

Password:

This is the password used with the User ID to log in to the FTP server.

> **NOTE:** Check with the System Administrator to obtain a username and password that will have permission to write files and subdirectories to the FTP directory.

Directory:

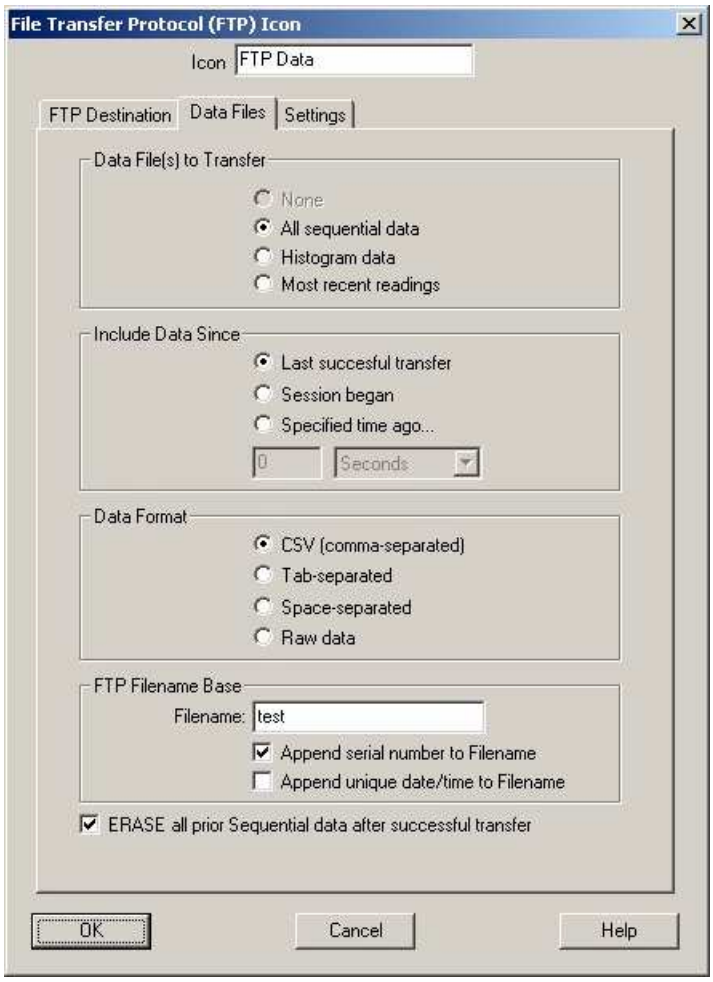
This is the name of the directory on the server where files will be stored.

> **NOTE:** this should normally be a *relative* pathname, beginning with **.**
> Typically, this value should not be left blank. Entering a period (**.**) usually specifies the use of the "default folder" assigned to the username/password being used.

CONFIGURATION DIALOG - DATA FILE TAB:

These settings can be used to optionally select the Time Span, Data Type and Format of the data to be transmitted, as well as specifying the name of the data file(s).

An additional option is available to instruct the Logger to clear the transmitted data from Logger memory after the data file has been successfully sent.



Data File(s) to Transfer:

This allows the selection of the Data Type to be included in the file.

NONE:
This option is grayed out because it does not apply to FTP.

ALL SEQUENTIAL DATA:
This option sends data from all RAM icons in the Program Net.

HISTOGRAM DATA:
This option sends data from Histogram icons only.

MOST RECENT READINGS:
This option selects data from the most recent reading from each Probe Point icon included in the Program Net. This does not include data from any RAM icons.

Include Data Since:

Selects the Time Span of data to be included in the file.

LAST SUCCESSFUL TRANSFER:
This option only sends data values that were not previously sent.

SESSION BEGAN:
This option sends all data since the beginning of the current session, when the Logger was enabled, regardless of whether it was previously sent or not.

SPECIFIED TIME AGO:
This allows the selection of data from a user-defined amount of time just prior to the Trigger event. A text box is provided for entry of a number. The Units (seconds, minutes, hours or days) can then be selected from the drop down list.

Attached Data Format:

This determines the format of the data in the files being sent. With the exception of Raw Data, each format translates the data into a human-readable spreadsheet-type format, with rows representing each Net Scan timestamp, and Columns representing each RAM icon.

CSV:
This option specifies column values will be separated by Commas (Comma Separated Values).

TAB-SEPARATED:
This option specifies column values will be separated by Tab characters.

SPACE-SEPARATED:
This option specifies column values will be separated by spaces, and filled to align columns on 35 character boundaries.

RAW DATA:
Data files will be sent in unformatted XID format, which is the raw format used by the logger and contains data as well as checksum information. This format is not human-readable, however is the most compact format and may be later used by HyperWare for additional processing, such as plotting.

FTP Filename Base:

This specifies the naming convention used for data files being sent.

FILENAME:
This value assigns a name to the file being sent.

APPEND SERIAL NUMBER:
Selecting this option will append the logger serial number to the Filename, allowing it to be distinguished from files sent from different Loggers.

APPEND DATE/TIME:
When checked, this option adds the date and time value to the filenames being sent, so that unique filenames are created to prevent overwriting earlier files.

Leave this option unchecked to replace old files with the latest ones on the computer the files are being sent to, if required.

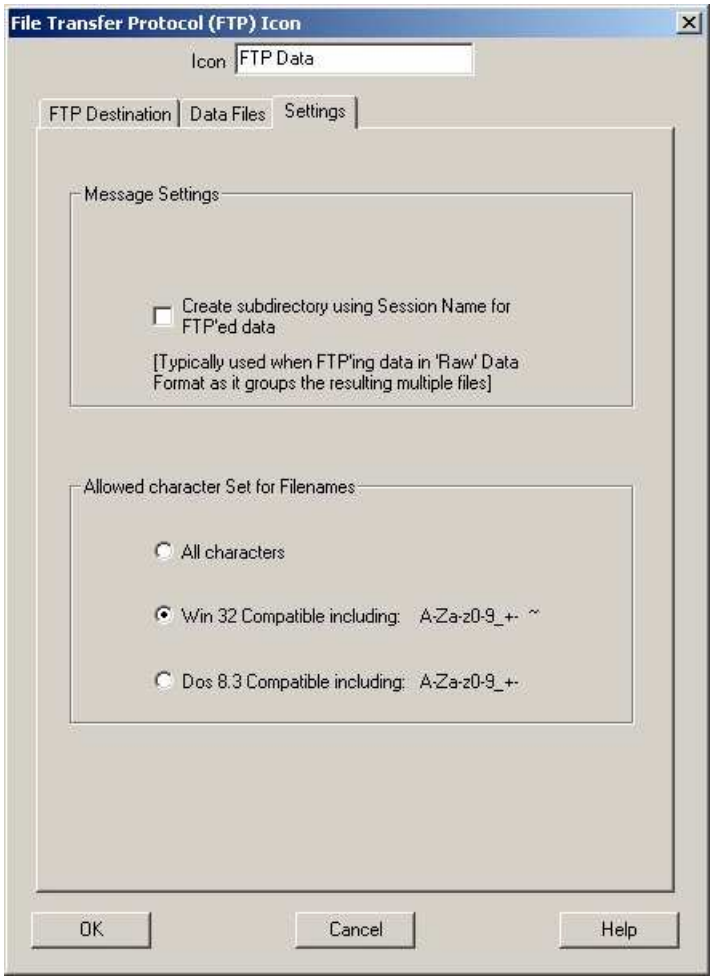
Erase:

When this option is checked, data that has been successfully transferred will be erased from the Logger. If the transmission failed, this data will remain intact.

Leave this option unchecked to keep all data in the Logger.

CONFIGURATION DIALOG – SETTINGS TAB:

This page provides the option of creating FTP subdirectories on the target FTP server and in addition allows the selection of the Character Set to be used for filenames associated with this icon.



Create Subdirectory:

This option will attempt to create and use a subdirectory on the FTP server based on the data session name. This subdirectory will be located in the directory specified on the FTP destination tab.

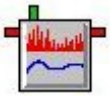
> **NOTE:** Check with the System Administrator to get a username and password that will have permission to write files and create subdirectories in the target FTP directory.

Allowed Character Set for Filenames:

This affects only warning messages generated while editing this icon.

This will ensure that filenames used will match the restrictions of the target system. For example, if the FTP data is going to a machine that only caters for short file names, select *DOS 8.3.*

FILTER ICON



FUNCTION:

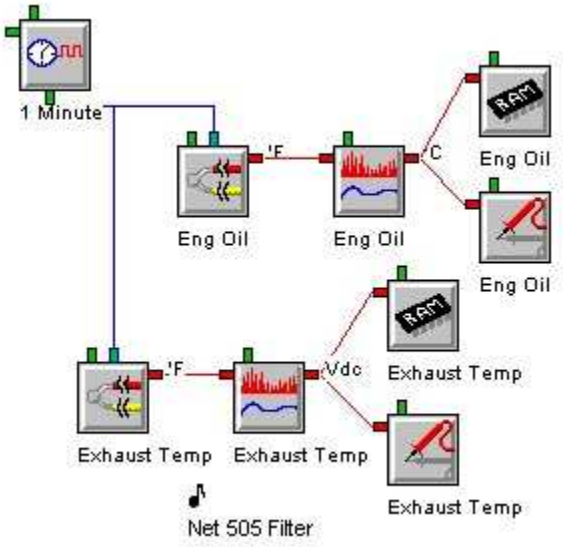
Provides two types of Data Filtering: a Sliding Average or a Low Pass Smoothing Filter. Filtering reduces the variation between consecutive samples in the data.

EXAMPLE APPLICATION PROGRAM NET:

Two temperatures in a Las Vegas taxi are monitored to research operating temperatures in the hot summer. Two critical points are selected to monitor. The filtered values are sent to RAM icons and Probe Points for viewing.

For the Exhaust Temp a Filter icon is used, which is capable of calculating a sliding average every minute for the last ten minutes. This example uses 10 samples, with a one minute sampling rate. As the 10th sample arrives the average is output. Every minute thereafter the average for the prior 10 minutes is output.

For the Eng Oil a Filter icon is used to calculate a low-pass smoothing filter. This example uses 7% smoothing. Every minute the smoothed value is output.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

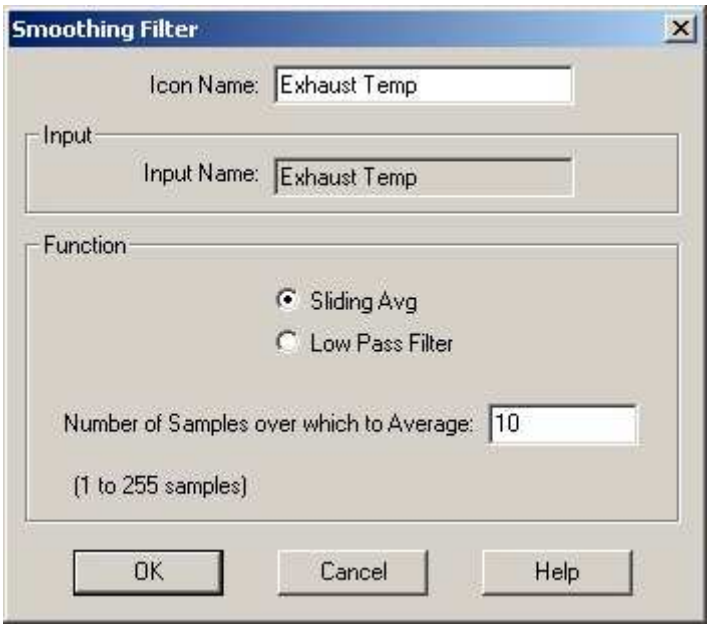
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

No Output is generated when the icon is disabled. When the icon is re-enabled, the filtering operation is re-started.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's Input Terminal.

Sliding Avg.:

When this is selected, a text entry box is provided for the

NUMBER OF SAMPLES OVER WHICH TO AVERAGE

For example, if *Number of Samples* is 5, when the 5th Sample is received, the Average of Samples 1 through 5 is Output. When the 6th Sample is received, the Average of Samples 2 through 6 is Output, then 3 through 7, etc.

For the first 4 Samples, the first value is used for the missing ones in the average:

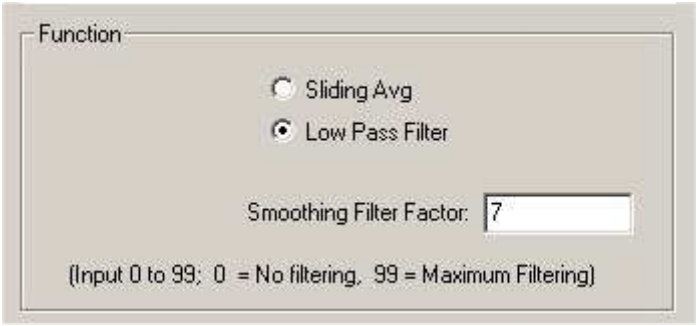
out[1] = (5 * in[1]) / 5

out[2] = ((4 * in[1]) + in[2]) / 5

out[3] = ((3 * in[1])+ in[2] + in[3]) / 5

out[4] = ((2 * in[1]) + in[2] + in[3] + in[4]) / 5

Low Pass Filter:



When this is selected, a text entry box is provided for the

SMOOTHING FILTER FACTOR (ALPHA)

Data will be filtered according to the low-pass alpha filter formula:

$$Out_{[n]} = Sample - (Sample - Out_{[n-1]}) * Alpha/100$$

LATCH ICON

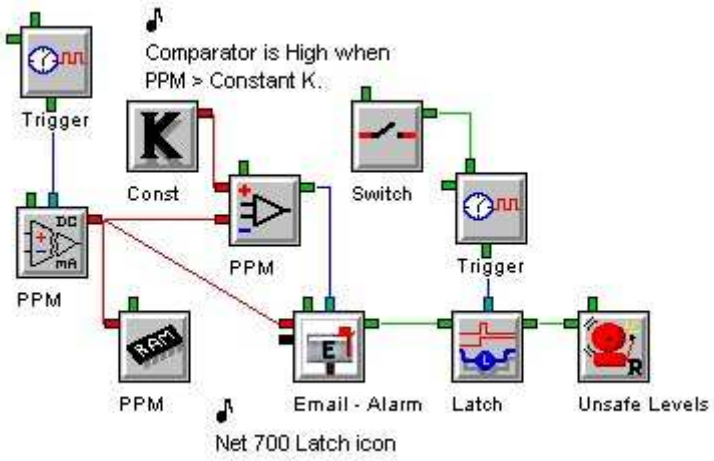
FUNCTION:

This icon can be used to keep an alarm Output on if the Input is only HIGH momentarily. A Trigger Pulse causes the Output to latch to the state of the Input at that instant, and remain in that state until the next Trigger Pulse occurs.

EXAMPLE APPLICATION PROGRAM NET:

This program is identical to the Delay icon program with one exception; the delay has been removed from the Email output. Intended to monitor and record the air quality in an Expanded Polystyrene factory, the program includes a Relay icon that latches if the Email icon detects an error.

If the air quality is poor, 1000 PPM or greater an email is generated to warn Operations. The 4-20mA input is sampled at a once per minute rate and the milliAmps to PPM conversion takes place in the DCmA input. The signal is sent directly to memory and also to a Comparator icon. If the output of the Comparator goes High then an emailed text message is sent to the operator's cell phone. If an error occurs while attempting to send the message, the Email icon's output will go High. This signal is latched High using the Latch icon, turning the relay on and keeping it on until reset.



CONNECTION TERMINALS:

Input: Logic Data

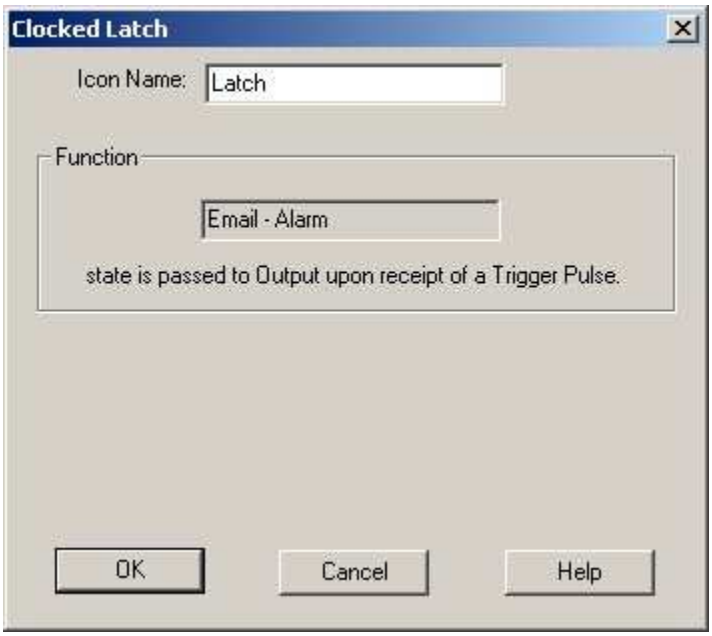
Trigger: Logic Control

Upon transition from LOW to HIGH, the signal from this Terminal forces the Output to latch to the current state of the Input.

Output: Logic Data

Maintains its state until the Trigger Pulse and Input force it to change.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

____ state is passed to Output upon receipt of a Trigger Pulse:

This reflects the name of the icon connected to this icon's Input Terminal. It is the state of this input that will be latched at the output when a trigger is applied.

LATCHED LCD MESSAGE (LCD EVENT) ICON

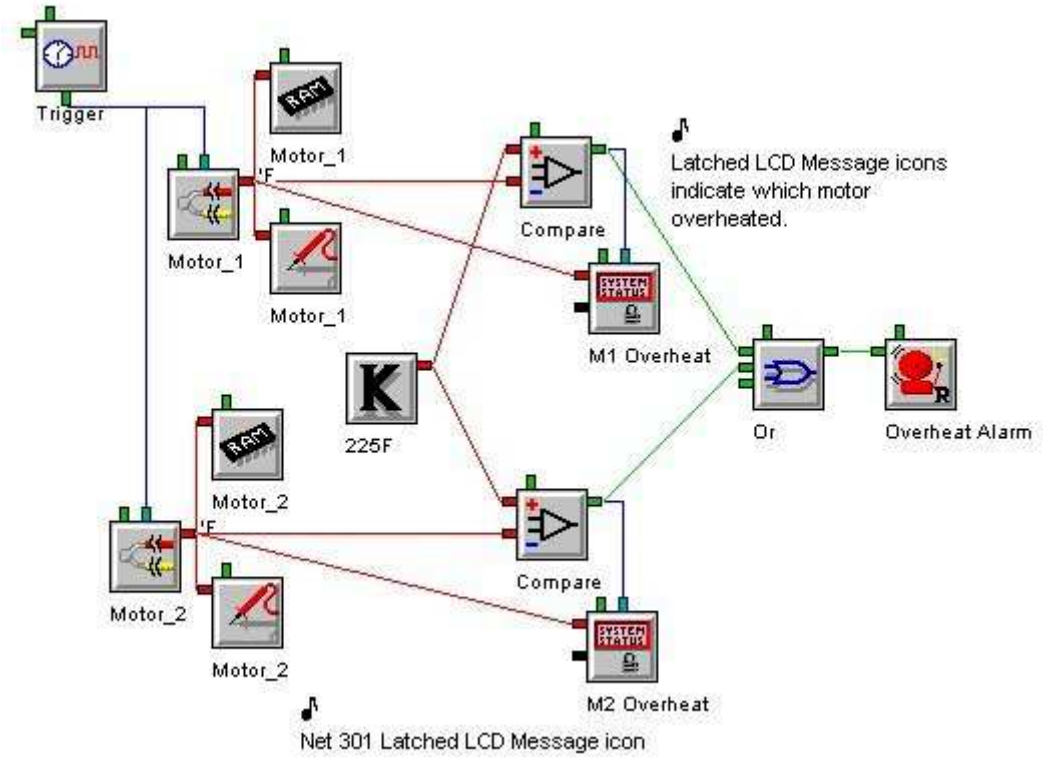
FUNCTION:

User-programmed messages can be displayed on the LCD (liquid crystal display) on the front panel of the Logger System Base. When its Trigger Input goes HIGH, this icon will add an *Event-Triggered* type of message to the list of Active Messages that are displayed on the LCD screen of the Logger and on the Status dialog of HyperWare-II. The value of each Input at the time of the event can be embedded in the message. Since this indicates a past event, it will remain in the list until cleared by the User.

> **Note:** The list of Active Messages can be reviewed via the Logger front panel Next / Select buttons menu *Active Messages* or via a *Status Query* from within the Communication Window.

EXAMPLE APPLICATION PROGRAM NET:

A Municipal Water District wants to watch the operating temperatures of two large pumps they believe will fail soon. Each pump is monitored by a thermocouple and compared to 225 degrees F as defined in the Constant icon K. If either of the Comparator icons' outputs go high, Relay Overheat Alarm is activated, triggering an audible and visual alarm. A message is also sent to the LCD via the Latched LCD Message icon for either motor. The message immediately identifies which motor overheated and its temperature at the time of the event.



CONNECTION TERMINALS:

Input: Analog or Logic Data

Each of these two Inputs can be connected to either data type, or left unconnected.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Upon each Trigger Pulse, if the icon is enabled, the specified message will be sent to the LCD screen.

> **Note:** Hardware Output (to LCD display) only. No Output terminal is shown on the icon for Program Net connection.

CONFIGURATION DIALOG:

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input 0 Name:

This reflects the name (i.e. Motor_1) of the icon connected to this icon's upper Input Terminal. If this optional connection is not used, it will be labeled Unconnected.

Input 1 Name:

This reflects the name of the icon connected to this icon's lower Input Terminal. If this optional connection is not used, it will be labeled Unconnected.

Message:

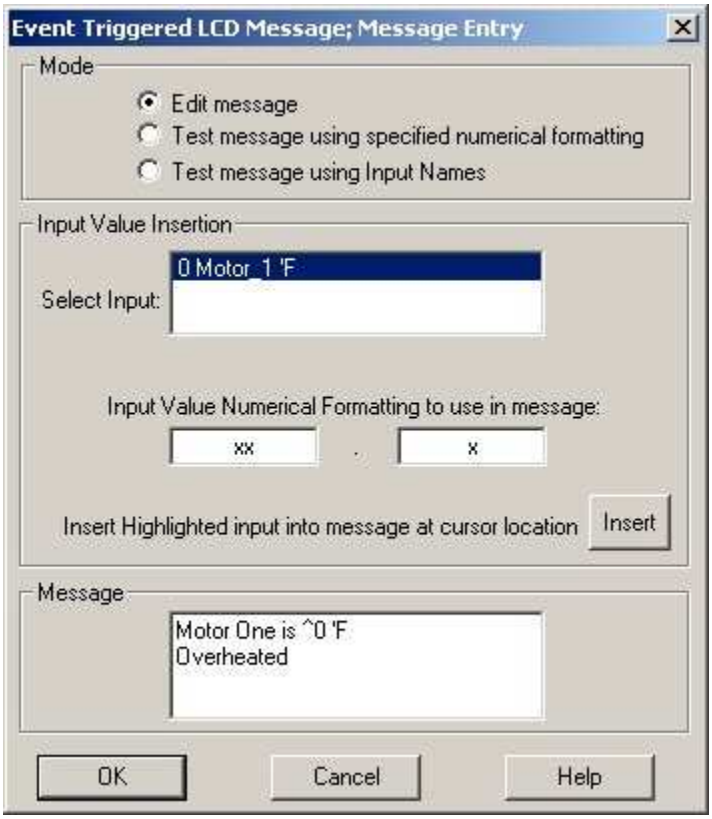
This displays a summary of the actual message. To edit the message, click on the ***Edit Message*** button.

> **Note:** inserted values will be displayed here as formatting keys, such as "##.#" or "^0".

Edit Message Dialog:

The Edit Message Dialog allows entry and formatting of the custom message for this icon. Each message can consist of up to two lines of text.

Because the message can be displayed on the LCD, a maximum of 20 characters per line is permitted.



Mode:

While editing this icon, Mode selection determines how text insertions will be displayed in the message window at the bottom of the dialog, providing a kind of preview function.

The formatting applied to Input Value Insertion entries (see below) affect the spacing, and therefore layout of the text when displayed on the LCD in these various display modes.

Message:

The text of the message is entered here, when 'Edit message' mode is selected.

To insert the values of inputs that are connected to this icon into a message, locate the cursor at the appropriate location within the message text, then highlight the desired Input from the *Select Input* list, and click on the ***Insert*** button. When each reference to an input value is added, it is assigned the currently specified Numerical Formatting (see below).

Special formatting keys are used to indicate each Input Value. These formatting keys are in the form of a caret (^) followed by the input number. For example, as shown above, the Input Value for Level would be represented as ^1 (because 'Level' is connected to input 1).

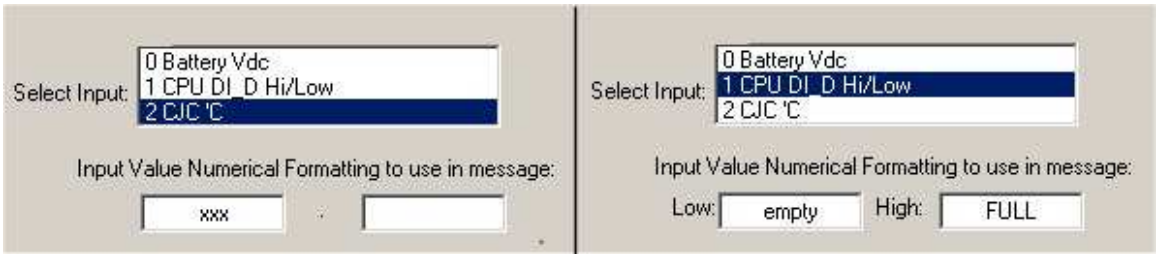
A limitation of these text messages is that only one embedded input value per line is permitted.

Select Input:

The input list displays the inputs connected to this icon whose input values are available for insertion into the message. The first column shown in the list is the Input number, the second column is the input's Name, and the final column is that Input's Units Text.

Input Value Numerical Formatting:

Values that are inserted into the text message can be formatted as decimal (floating-point) numbers, whole integers, or in the case of Logic Data, as text.



When working with Logic Data, you must enter text for both HIGH and LOW conditions. Each description can be up to 11 characters in length.

Decimal and integer numbers are also restricted to 11 characters, including the decimal point, if one is present.

In the examples above, CJC will be displayed as a whole integer, and for CPU_DI_D, either "empty" or "FULL" will be inserted into the message as applicable at the time.

> **Note**: be sure to allocate the maximum expected digits to the left of the decimal point, or the end of the line may get truncated.

LOGICAL AND ICON

FUNCTION:

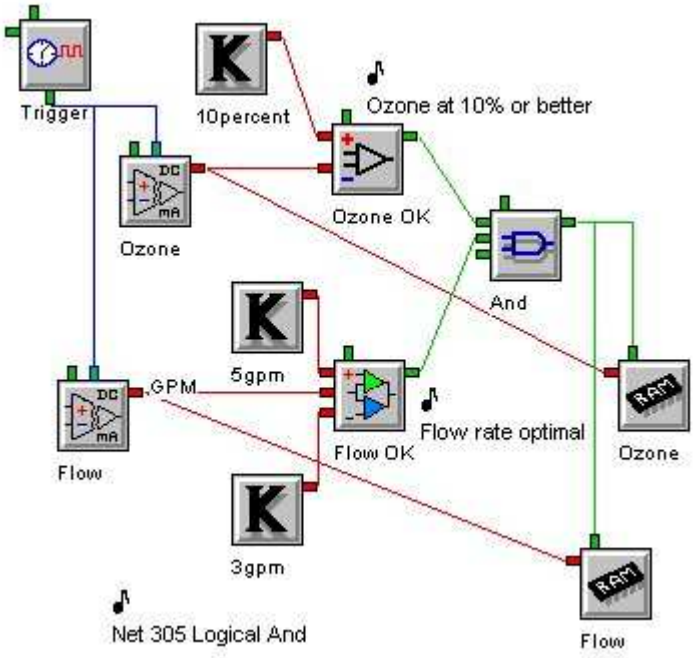
The Output turns HIGH *ONLY* when all of its Inputs are HIGH. If any of the Inputs are LOW, the Output is LOW.

EXAMPLE APPLICATION PROGRAM NET:

The manufacturer of a water purification system that utilizes ozone wants to record two parameters, water flow and % ozone in some test systems. They only care about recording the data when water flow is at a certain rate and ozone is above a certain percentage.

A single sample rate clock (Trigger) controls both inputs, which are sampled every 10 seconds. The flow rate (Flow) is sent to a Window Comparator (Flow OK) with two Constants (5gpm and 3gpm), and the ozone percentage (Ozone) is sent to a single comparator (Ozone OK). The outputs of each Comparator go into a Logical And icon (And) which controls the RAM icons for each of the two Inputs.

When both Comparator Outputs are HIGH, the Output of the Logical And icon will be HIGH, allowing data to be stored, by enabling the Memory icons.



CONNECTION TERMINALS:

Inputs: Logic Data

As an Input Terminal is connected, a new one will appear on the Logical And icon, up to a maximum of 24 Input Terminals.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

List of Inputs:

This is a drop-down list containing the names of the icons connected to this icon's Input Terminals (i.e. Flow OK, etc.). This is used for informational purposes only.

Show additional Inverted Output Terminal:

When checked, this option provides an additional Output Terminal whose state will always be the opposite of the primary output. This is a simple way to handle both possibilities without needing to add an Inverter icon.

When this option is left unchecked, only the primary output Terminal will be available.

Latch Output state upon meeting And condition:

When checked, this option will force the Output to remain HIGH when it first goes HIGH.

When this option is left unchecked, the Output will return to LOW whenever any of the Inputs go LOW.

LOGICAL EXCLUSIVE OR (XOR) ICON

FUNCTION:

The Output turns HIGH when the state of the two inputs are different, i.e. *ONLY ONE* of the Inputs is HIGH. If neither or both of the Inputs are HIGH, the Output is LOW.

CONNECTION TERMINALS:

Inputs: Logic Data

There are only two Inputs for the Exclusive OR icon.

Enable: Logic Control

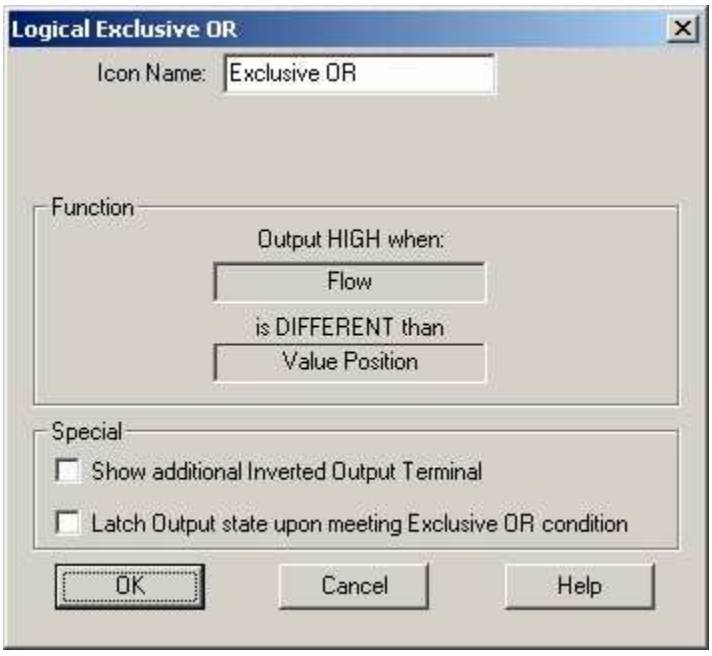
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Output HIGH when:

This field reflects the name (i.e. Flow) of the icon connected to this icon's upper Input Terminal.

Is DIFFERENT than:

This field reflects the name (i.e. Value Position) of the icon connected to this icon's lower Input Terminal.

Show additional Inverted Output Terminal:

When checked, this option provides an additional Output Terminal whose state will always be the opposite of the primary output. This is a simple way to handle both possibilities without needing to add an Inverter icon.

When this option is left unchecked, only the primary output Terminal will be available.

Latch Output state upon meeting And condition:

When checked, this option will force the Output to remain HIGH when it first goes HIGH.

When this option is left unchecked, the Output will return to LOW whenever both Inputs match.

LOGICAL INVERTER (NOT) ICON

FUNCTION:

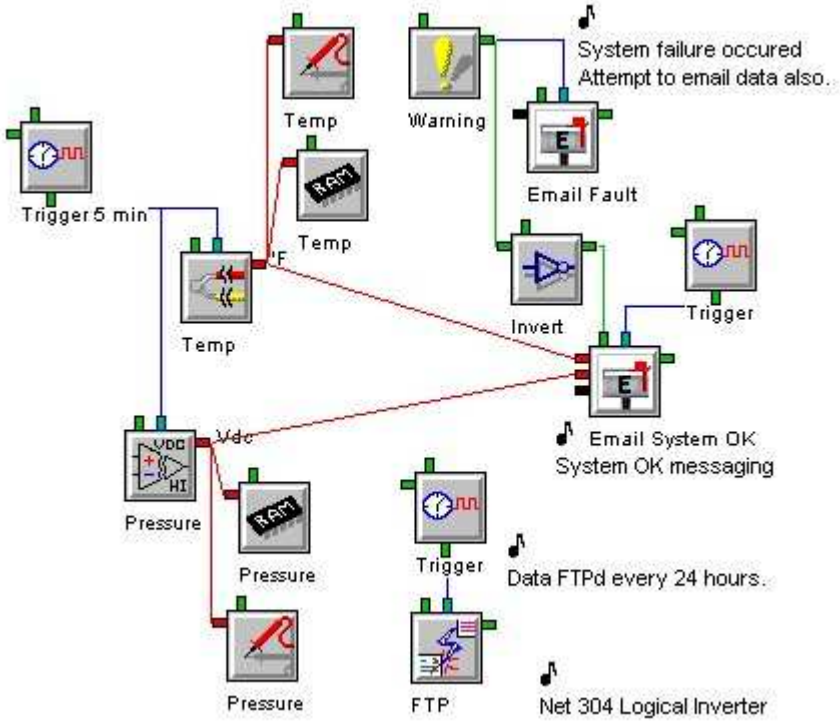
The NOT icon inverts signals passing through it. When the Input is HIGH the Output will be LOW. When the Input is LOW, the Output will be HIGH.

EXAMPLE APPLICATION PROGRAM NET:

A manufacturing company is monitoring the temperature and pressure of an important process. They wish to know if any faults occur with the data logger and also have a regular heartbeat email that assures them the logger is operating properly and recording the data of this critical process. When the Warning icon indicates a fault it immediately triggers the Email Fault icon to send an Email indicating attention to the system is needed.

When a logger fault is not present, the Inverter icon flips the Low Warning icon signal to a High signal which enables the System OK Email icon. The Email icon, Triggered hourly with the Sample Rate Clock, sends this regular message indicating so with the latest temperature and pressure readings.

The program also sends data using FTP regularly on a 24-hour schedule. If a fault does occur Email Fault is programmed to send the last data attached to the email.



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

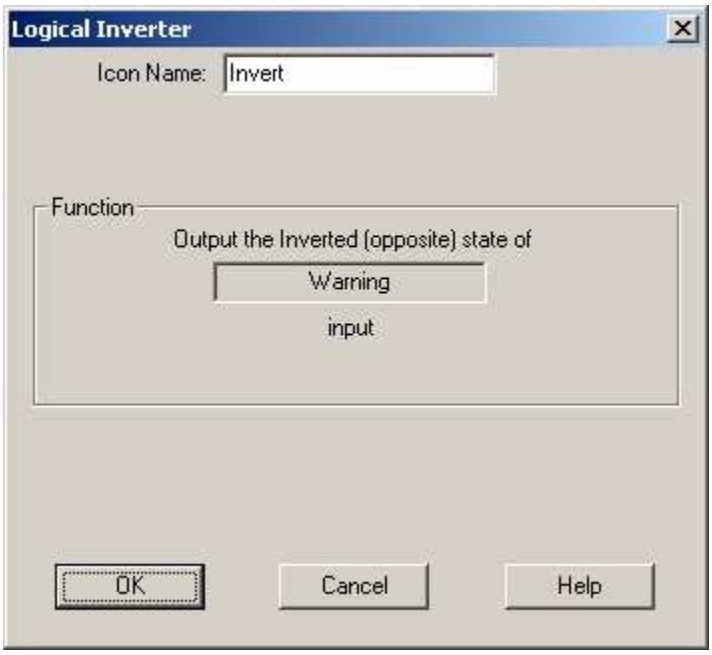
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name (i.e. Warning) of the icon connected to this icon's Input Terminal

LOGICAL OR ICON

FUNCTION:

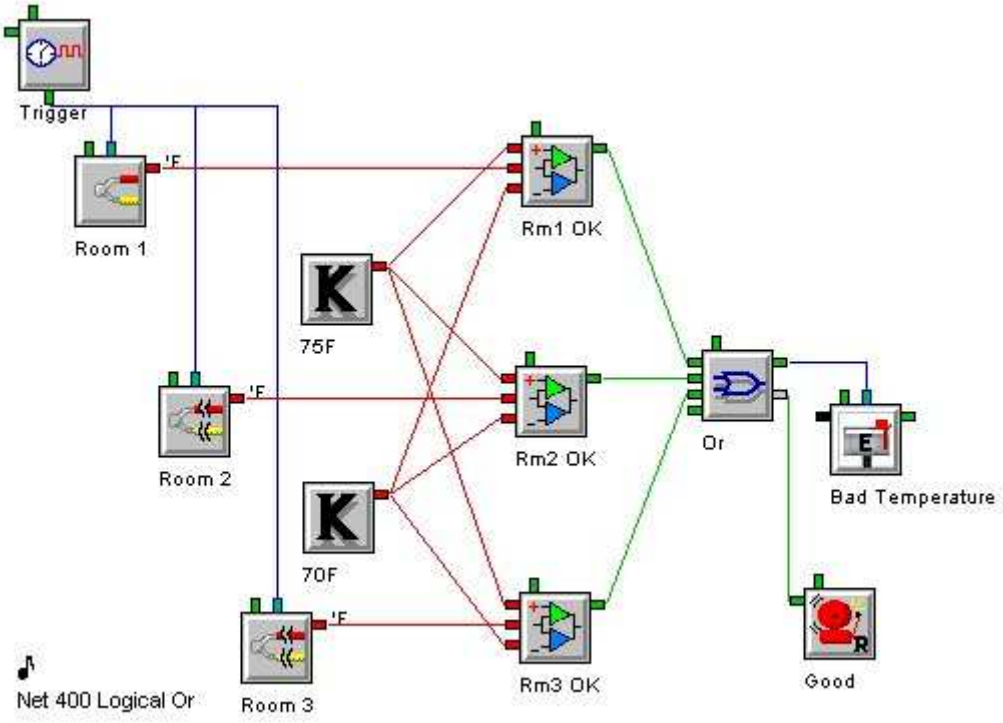
The Output of this icon goes HIGH whenever any of its connected inputs are HIGH. If all of the inputs are LOW, then the Output will be LOW.

EXAMPLE APPLICATION PROGRAM NET:

A University Physics lab wants to monitor, record and maintain lab temperature between 70 and 75F. They have a building automation system that does not seem to be working properly so they installed an IntelliLogger to monitor the system's performance. Each room has a single thermocouple, configured with a Fahrenheit Output.

Two Constant icons supply the high and low temperature values for three Window Comparators. When any of the monitored temperatures move outside the 75 to 70F acceptable range, its Window Comparator passes a High signal to the Logic Or which triggers an Email.

This means that any of the Window Comparator's outputs going High will trigger an email. The Logic Or icon also has an inverted Output which keeps a relay closed when all the Inputs of the Logical Or are Low. The relay completes a circuit for a larger relay that powers a visible green light in a control room. When the light is green all rooms are within the desired temperature range.



CONNECTION TERMINALS:

Input: Logic Data

Whenever an Input Terminal is connected, a new one will appear on the Logical OR icon, up to a maximum of 24 Input Terminals.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

List of Inputs:

This is a drop-down list containing the names of the icons connected to this icon's Input Terminals. This list is for informational purposes only.

Show additional Inverted Output Terminal:

When checked, this option provides an additional Output Terminal whose state will always be the opposite of the primary output. This is a simple way to handle both possibilities without needing to add an Inverter icon.

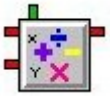
When this option is left unchecked, only the primary output Terminal will be available.

Latch Output state upon meeting Or condition:

When checked, this option will force the Output to remain HIGH when it first goes HIGH.

When this option is left unchecked, the Output will return to LOW whenever all of the Inputs go LOW.

MATH FUNCTION ICON



FUNCTION:

The Math icon accepts one or two Input signals, then performs the designated mathematical calculation based on their values, and then outputs the result.

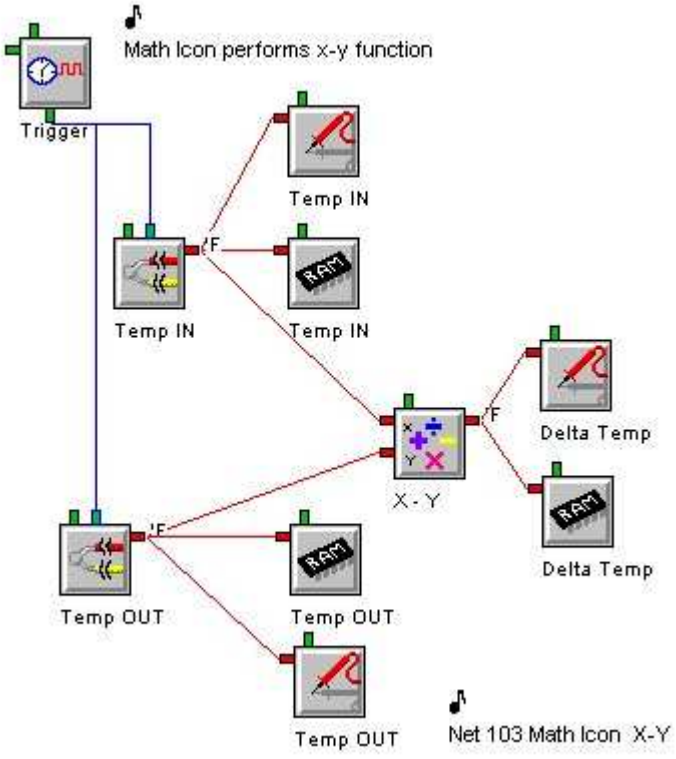
Equations used in these icons may be optionally saved to and selected from a user-defined Math Library.

The two Program Nets below illustrate how a Math icon may be used in two different manners. Equations for one or more Inputs may be manually entered. Alternatively, for conversion of a single input in Linear Scaling (mX+b) applications, equations can be generated by using the integrated Equation Generator.

EXAMPLE APPLICATION PROGRAM NET ONE:

This Program Net samples two thermocouples across a heat exchanger, and calculates the temperature differential.

The inlet and outlet temperatures (Temp IN and Temp OUT) are measured using thermocouples. Each thermocouple value is sent to a Probe Point icon and to a Memory icon for display and storage. Both temperature values are sent to a Math icon which performs the simple calculation (X - Y) for the differential value (Delta Temp). This calculated Delta Temp is then sent to a Probe Point icon and a Memory icon.

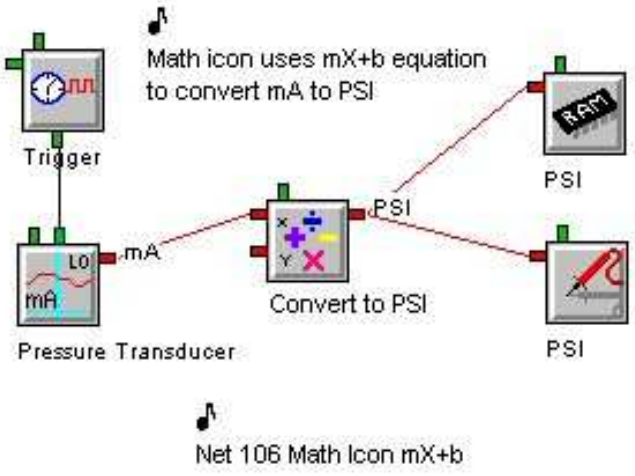


EXAMPLE APPLICATION PROGRAM NET TWO:

This Program Net was needed for an oil storage customer, who needed to monitor the pressure within a storage container. A pressure transducer was connected to the input icon, which sends the value to a Math icon, where it is converted to engineering units (PSI). In this example the Input range of 4-20 mA from the transducer represents a range of 0-100 PSI.

In this example, the math icon is performing the scaling function to translate the 4-20 mA signal into PSI using the **(6.15839 * x) + -25.4342** equation (See the Generate Equation paragraph below for details on how this equation was calculated).

It is worth noting that the input icon is also capable of performing this scaling internally, but for the purposes of this example, a math icon was used.



CONNECTION TERMINALS:

Inputs: Analog Data

The second Input is optional. If only one input is used in the equation, the other input should be left unconnected.

Enable: Logic Control

Processing of icon is allowed:

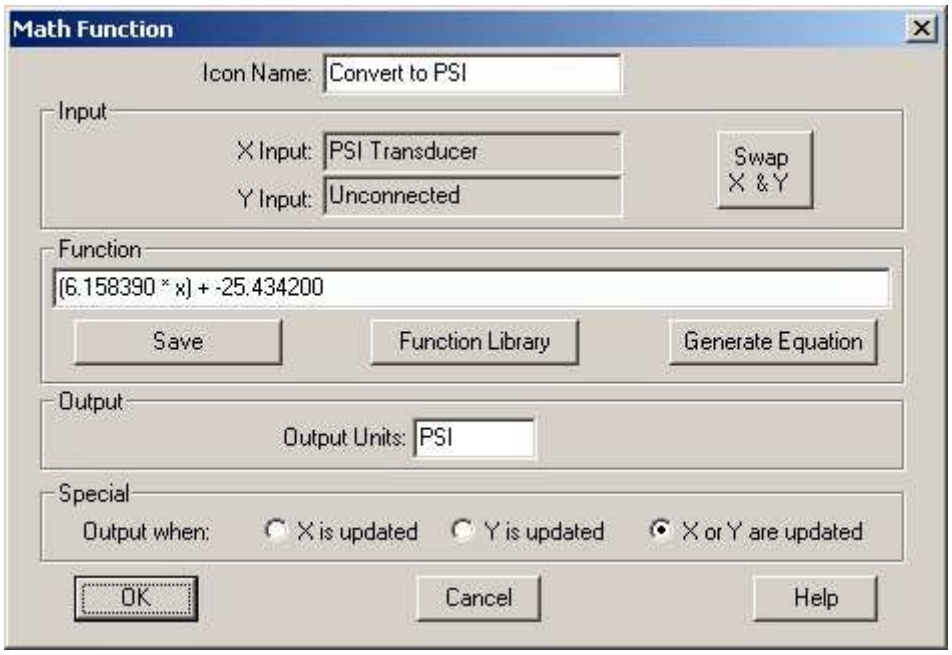
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

This is the value of the Math calculation result.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

X and Y Inputs:

These reflect the names (i.e. PSI Transducer) of the icons connected to this icon's Input Terminals. X represents the upper Terminal. The Y Input Terminal is optional. If it is left empty, Y Input will be labeled Unconnected.

Swap X and Y:

Clicking on the ***SWAP*** button swaps the X and Y Input connections. The change is reflected in the X and Y Input Name boxes as well as in the actual Program Net where the connections are redrawn.

NOTE: The Function area, including Save, Function Library and Generate Equation buttons are described below in detail.

Output Units:

This provides a text box for User entry of a Units label that will be shown at the Output of this icon.

Output When:

This option defines in what circumstances the Output value will be updated. This may be useful if the inputs to the icon are updated at different times/rates (asynchronously).

X input Updated:

When this option is selected, the Output is updated only when the X Input is updated. If a calculation is performed that uses the Y Input, the last Y Input value will be used in the calculation and the Output will be updated.

Y input Updated:

When this option is selected, the Output is updated only when the Y Input is updated. If a calculation is performed that uses the X Input, the last X Input value will be used in the calculation and the Output will be updated.

X or Y Updated:

When this option is selected, the Output is updated if either of the X or Y Inputs is updated.

Function:

A text box is provided for entry of the equation to be calculated. In the equation, use **X** and **Y** to represent the values at the X and Y Inputs. Supported math Functions, their Syntax, and Explanations are provided in the following table:

FUNCTION	SYNTAX	EXPLANATION
Addition	X+7	Adds 7 to Input X
Subtraction	X-20	Subtracts 20 from Input X
Multiplication	X*1.2	Multiplies X times 1.2
Division	X/2	Divides X by 2
Exponentiation	X^3	X cubed
Exponential	EXP(X)	e to Xth power
Parenthesis	2*(X-Y)	2 times the difference of the X Input minus the Y Input
Square	SQR(Y)	Y squared
Square	Root SQRT(X)	Square root of X
Absolute	Value ABS(Y)	Absolute value of Y
Zeroize	ZERO(X)	Zero if X is negative, X otherwise
Natural	Log LOG(Y)	Natural log of Y
Log	Base 10 LOG10(X)	Base 10 log of X
Sine	SIN(Y)	Sine of Y
Cosine	COS(X)	Cosine of X
Tangent	TAN(Y)	Tangent of Y
ArcCosine	ACOS(X)	ArcCosine of X
ArcSine	ASIN(X)	ArcSine of X
ArcTangent	ATAN(X)	ArcTangent of X
ArcTangent2	ATAN2(Y)	ArcTangent2 is accurate for values of X very close to and equal to 0

Function Library:

A math Function Library is provided, allowing the storage of user-defined equations that may be used frequently.

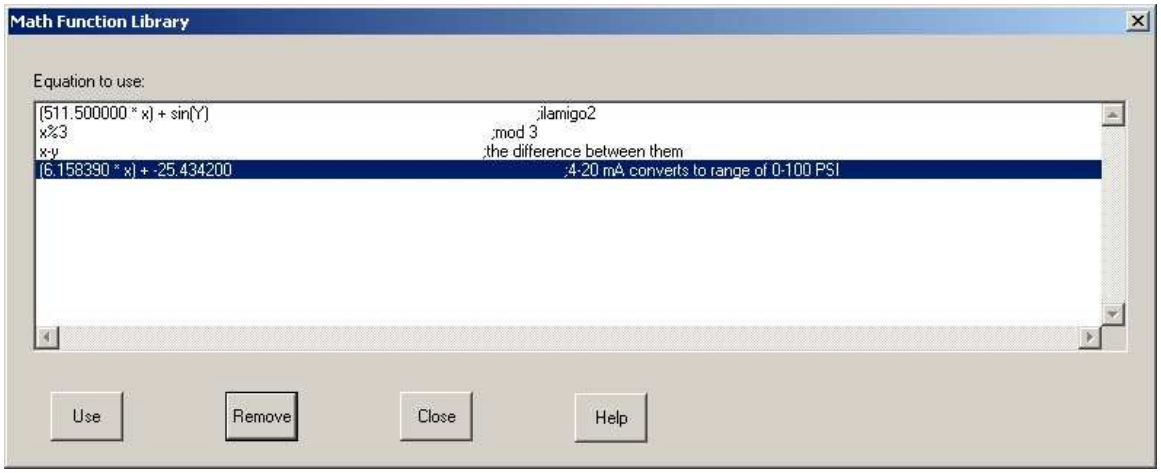
To save a function to the Library, enter the equation in the Math Function text box, then click the ***Save*** button. A dialog will be displayed, allowing for user entry of a short comment describing the function being saved.

Clicking the ***OK*** button saves the function to the Function Library for future recall. Once saved, the Math Function Library dialog will be displayed.

To retrieve a previously saved function for use, click the ***Function Library*** button, which will open a dialog allowing access to the Library where user-added equations are retained.

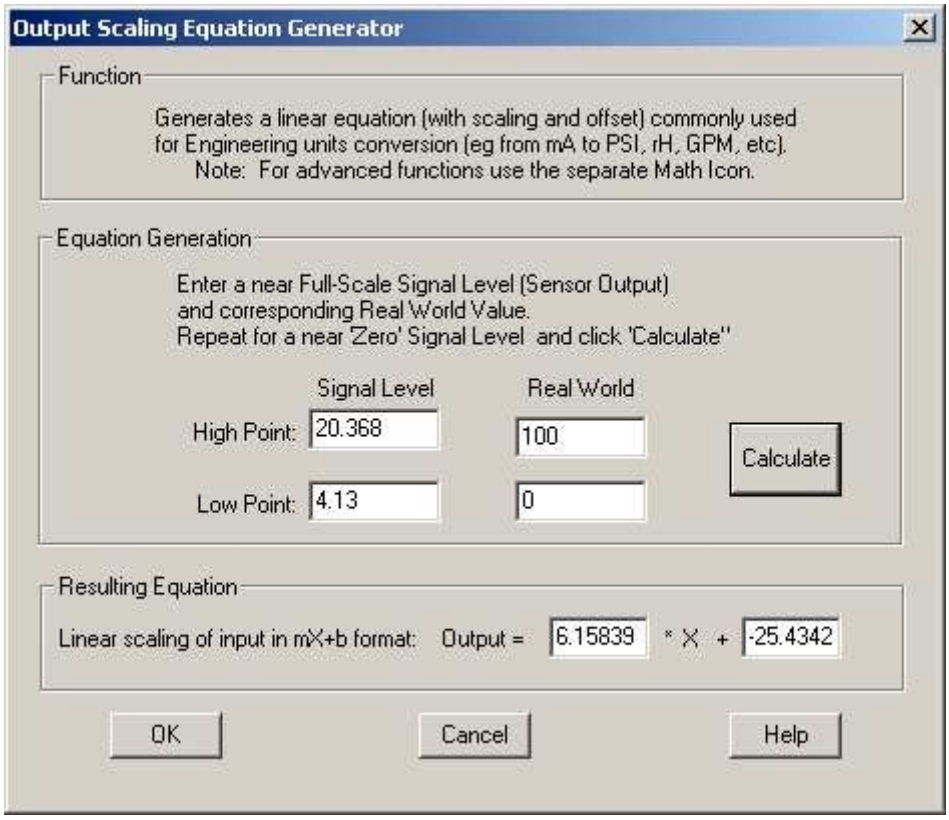
Highlight the desired equation and click on the ***Use*** button to have the function loaded into the Math Function text box.

To delete an equation from the Library, highlight it, and then click on the ***Remove*** button.



Generate Equation:

In the example below, a 4-20 mA output pressure transducer is attached to the logger. The pressure transducer's input range is 0-100 PSI.

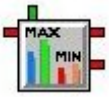

Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate''
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

Output = mX + b

To create a function, enter the calibrated (measured) range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that these values represent (0 to 100 PSI in this case). Clicking on the ***Calculate*** button will automatically generate the values for m and b (6.15839 and –25.4342, respectively in this example). Finally, clicking ***OK*** returns to the main Math dialog and inserts the updated equation into the Function box automatically.

MINIMUM AND MAXIMUM (MIN/MAX) ICON



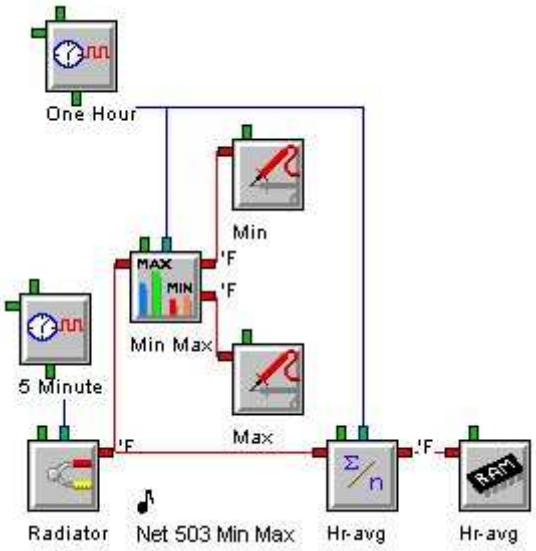
FUNCTION:

Detects the minimum and maximum data values passing through the icon. The Min/Max icon will accumulate a user-specified number of input samples, then calculate and output both the minimum value and the maximum value received during that period.

EXAMPLE APPLICATION PROGRAM NET:

This is an example Net program that monitors the temperature of a radiator every five minutes. In addition to storing a one-hour average, a Min Max icon has been included which will also output the minimum and maximum values to probe point icons.

Since the same Sample Rate Clock triggers both the Average icon and the Min Max icon the sample period will be the same.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

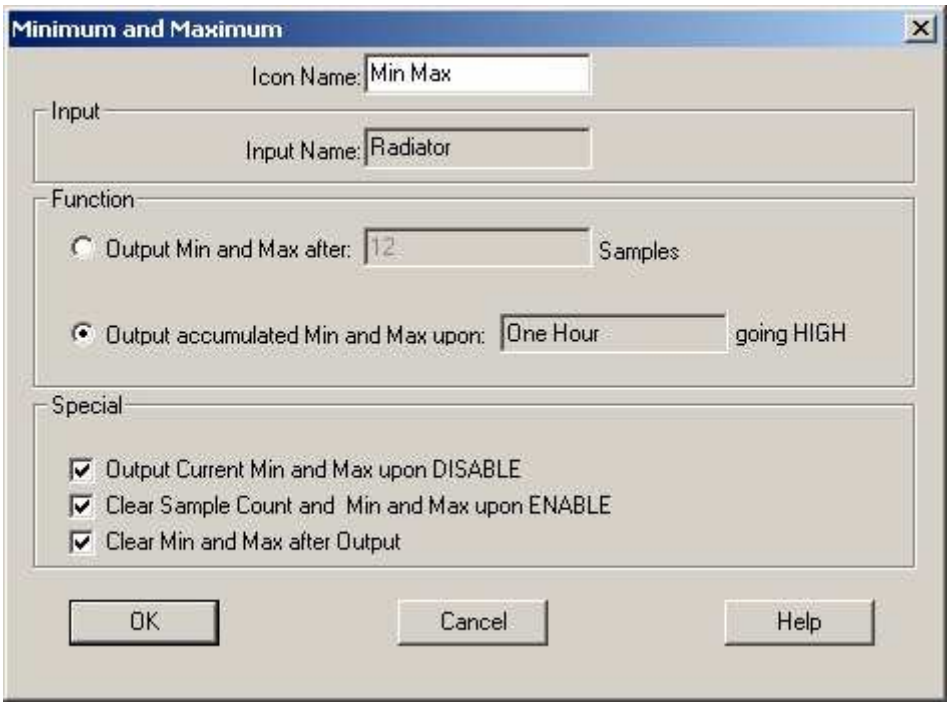
Trigger: Optional Logic Control

When 'Triggered' Mode is selected, an additional Optional Trigger terminal appears on the top of the icon. Upon transition from LOW to HIGH, the current Minimum and Maximum values will be updated at the icon's output terminals.

Outputs: Analog Data

The upper Output Terminal is the Minimum, and the lower one is the Maximum.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's Input Terminal.

Output Min and Max after:

If this option is selected, the number of samples entered will be buffered up (accumulated) before the Minimum and Maximum will be calculated and output.

Output accumulated Min and Max upon:

If this option is selected, an *Optional* Trigger Terminal appears at the top of the icon. A signal transitioning from LOW to HIGH on this pin will force the Minimum and Maximum to be calculated from the accumulated samples and output.

Output Current Min and Max upon DISABLE:

Select this option to force an output of the Minimum and Maximum thus far, at any time that the icon is disabled. If this option is *not* checked, upon receipt of a disable signal, the Min/Max calculation will be suspended until the icon is re-enabled and no in-process value will be output.

For example, if Minimum and Maximum values are to be calculated over 10 samples but only 7 have been received when the icon is disabled, the 7 sample Minimum and Maximum will be output, and the Min/Max calculation will be suspended until re-enabled. When the icon is re-enabled, the calculation will continue and after 3 more samples are received, the 10 sample Minimum and Maximum will also be output (unless the following *Clear Sample Count…*option is selected).

Clear Sample Count and Min and Max upon Enable:

Select this option to force a reset of the Min/Max calculation values and of the sample count used for the calculation, whenever the enable signal is applied.

If this option is not selected, the Average calculation will proceed from its suspended state (which it entered when it was disabled) each time the icon is enabled.

Clear Min and Max after Output:

Whenever this option is selected, each time the values are output, the Minimum and Maximum values will be cleared and a new calculation will start as new samples arrive.

If this option is *not* selected, new samples will continually be added and calculated into the accumulating Minimum and Maximum values.

MODBUS SLAVE / SERVER DEVICE ICON

Read Mode icon

Write Mode icon

FUNCTION:

The Modbus Slave / Server Device icon is employed when the IntelliLogger will be used as a Modbus *Master* or *Client* and will be accessing data from a Modbus *Slave* or *Server* device (if you are trying to use the IntelliLogger in the Slave/Server mode then refer to **Modbus Register List Icon**). Integration of the Modbus Slave Device icon into a Program Net allows the IntelliLogger to read data from or write data to registers in the connected Modbus Slave/Server device.

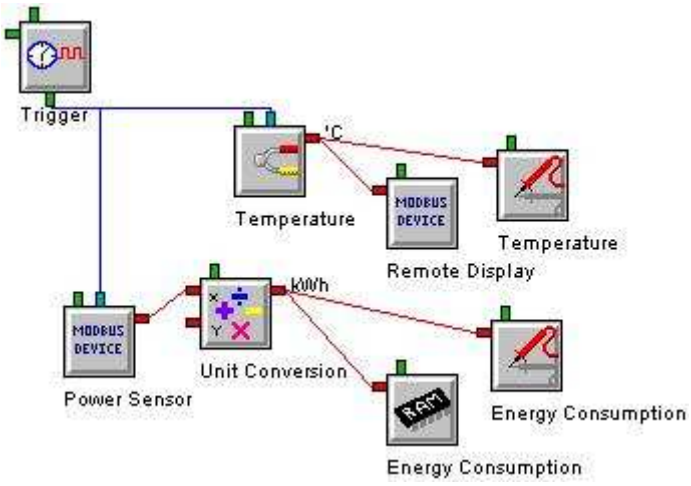
A Modbus Slave Device icon is added to the Program Net for each Register that is to be read from or written to in the connected Modbus Slave/client device(s). Use of this icon allows for an IntelliLogger to garner readings from one or more Modbus connected devices as well as from hardwired analog and/or digital inputs.

EXAMPLE APPLICATION PROGRAM NET:

This is an example Net program that monitors the temperature and energy consumption of a large space heater.

The temperature is monitored with a thermocouple connected to a thermocouple input and is written to a remote display that communicates using the Modbus protocol.

Energy consumption is monitored by reading a value from a power sensing harness that communicates using the Modbus protocol. The readings are converted to understandable units of kilowatt-hours (kWh) and stored to the IntelliLogger's internal memory using the Memory icon.



CONNECTION TERMINALS:

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control.

Only available in icons configured in the Read mode.

If the icon is Enabled, upon receipt of a logic trigger signal (e.g. from an connected Sample Rate Clock as shown) a command is sent to the connected Modbus Slave/Server device and the received response is then passed to the next icon in the Program Net. In the above example, the Modbus Slave/Server device response is passed to the Math icon where unit conversions are performed.

Input: Analog Data.

Only available/applicable when the icon is used in the Write mode.

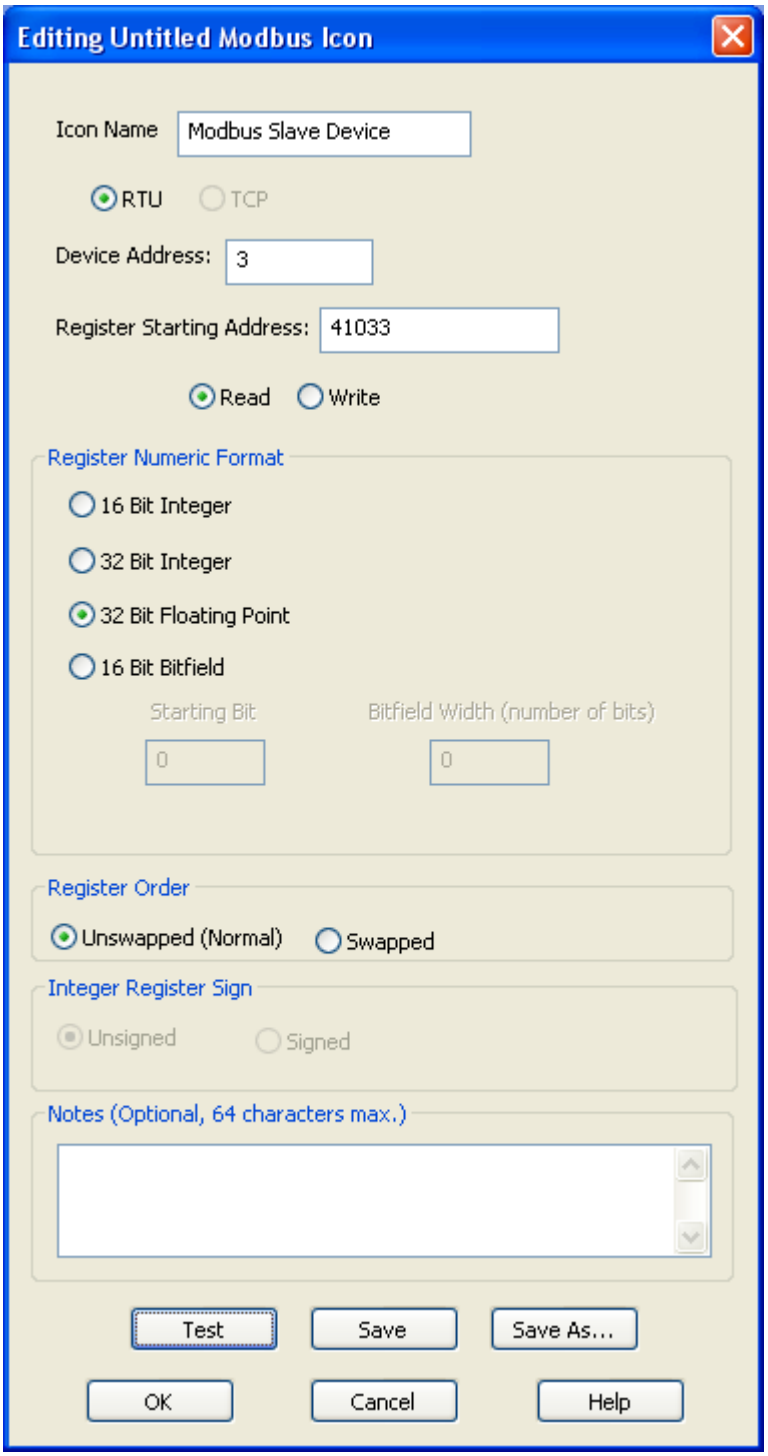
This is the value to be written to a Modbus slave device register.

Output: Analog Data.

Only available/applicable when the icon is used in the Read mode.

This is the value read from a Modbus slave device register.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

RTU / TCP:

This allows the user to specify which version of the Modbus communication protocol to use. Depending on the Modbus option(s) available on the connected IntelliLogger, one or both of these options may display.

Remote Terminal Unit (RTU) protocol communicates with Modbus Slave devices via the IntelliLogger RS-232 Port. For RS-485 (2 or 4-wire) RTU connections, utilize Logic Beach's Serial Communication Module (SCC-1) and the IntelliLogger's RS-232 [PC] connection port.

Transmission Control Protocol (TCP) communicates with Modbus TCP Server devices over a network and utilizes the IntelliLogger's Ethernet connection port and conventional CAT5 cable.

Device Address:

This is the address of the actual Slave/Server *device* (i.e. not the Register) with which with the IntelliLogger will communicate for this parameter. Each Modbus device that the IntelliLogger will communicate with must have a unique address. Valid device addresses are from 1 to 247 although not all devices can be assigned addresses over this full range. Refer to the device User's Manual for supported addresses, assign a unique address then match that address in this field.

Register Starting Address:

Each parameter (e.g. flow rate, Vac, Phase A voltage, mass flow rate, etc) in a Modbus device has an address associated with the register that holds that data. Enter the starting address for the desired parameter per the device manufacturer's Modbus Register listing.

If a single register (16 bits) is used, then enter the address of that register. If two registers are used for the parameter, enter the address of the lower numbered register. All Modbus Slave/Client devices should have in their User Manuals, a table of available parameters with their associated addresses.

Read / Write:

Radio button selection defines whether the IntelliLogger will read data from or write data to a register in a Modbus Slave/Server device.

Depending on this selection, the bitmap graphic of the Modbus Slave Device icon will change. As a Write configured Register, the input terminal (on the left) will display. As a Read configured Register, an Output terminal on the right side will display (along with a Trigger input terminal in the center top of the icon).

Register Numeric Format:

This selects the format of data being accessed in the Slave/Server device register. 16 Bit Integers and 16 Bit Bitfields are contained in single registers. 32 Bit Integers and 32 Bit Floating Points are each contained in two consecutive registers.

If a 16 Bit Bitfield is selected, the user must also specify how many bits are used to define the parameter of interest (e.g. 2 bits could be used to define 4 settings of a motor… Off, Low, Med and High) and which bit in the register is the leftmost bit. Refer to the device User's Manual for the Register format.

Register Order:

In 32-bit Format values (e.g. 32 bit Integer), two 16 bit Registers are used. The user must specify how data is ordered in the concatenation of these two registers.

"Unswapped (Normal)" should be selected if the *most significant* digits are in the first, or lower address register.

"Swapped" should be selected if the *least significant* digits are in the first register. Refer to the device User's Manual for the Register format.

Integer Register Sign:

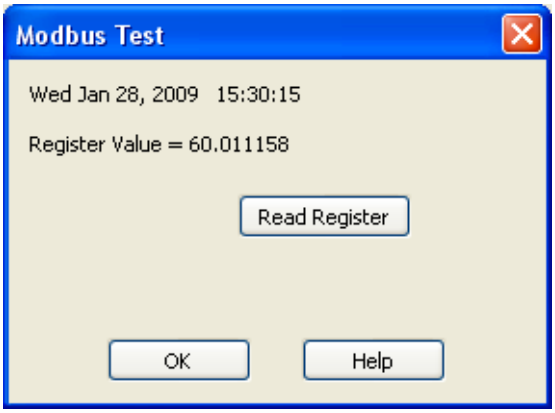
When an Integer format is selected (above), the user must specify whether the desired parameter register uses an "Unsigned" integer, where all values are positive and no negative values can occur, or a "Signed" integer, where both negative and positive values are possible.

Notes (Optional, 64 characters max.):

This allows the user to write a note about the icon, device, registers, format or whatever they choose, and keep it inside that specific icon's Configuration Options dialog. This Note will be saved with the icon in the Program Net and with the icon if saved to a library.

Test:

Use this button to open the "Modbus Test" dialog and test the specified configuration of the icon (per this dialog), the connection, the end device, etc. A test should always be done to confirm proper operation of the icon prior to unattended deployment.

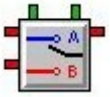


Save:

Modbus icons can be saved to disk as files (extension *.mbi) for later use. This can save time in reuse in that they can be simply opened from disk, modified slightly for the new application (e.g. change the Device Address) and incorporated into a new Program Net. For organizational purposes, a folder (directory) can be made for each device and associated Modbus Slave/Server Device icons can be saved under that device directory.

To add a previously saved Modbus icon to a Program Net, the user must select "Add Saved Icon" from the Modbus menu at the top of the Program Development Window.

MULTIPLEXER (MUX) ICON



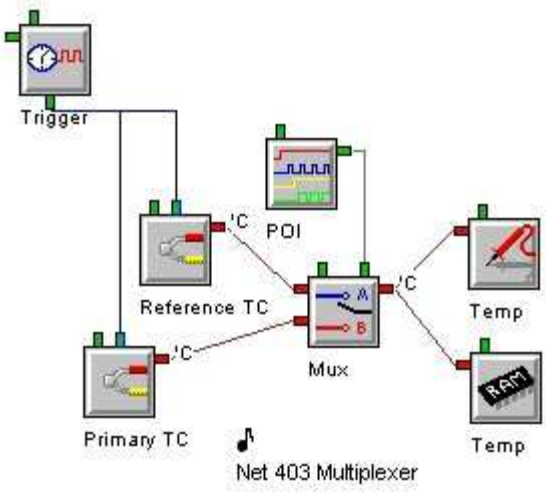
FUNCTION:

This icon will pass through the signal from one of its two Inputs. Which of these inputs permitted to pass through depends on the state of the icon's Select Control input. When the Select Control input is LOW, Input A will be passed to the Output. When the Select Control input is High, Input B will be passed.

EXAMPLE APPLICATION PROGRAM NET:

This example program net was used by a customer whose data file was to be parsed by a legacy program that expected hourly reference measurements in the same data column (RAM Icon) as the primary sampled data.

For the first minute of each hour, the POI Output will go HIGH, causing the MUX to pass along the Reference reading (Reference TC). The rest of the time it will pass along the normal Thermocouple reading (Primary TC).



CONNECTION TERMINALS:

Inputs: Analog Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

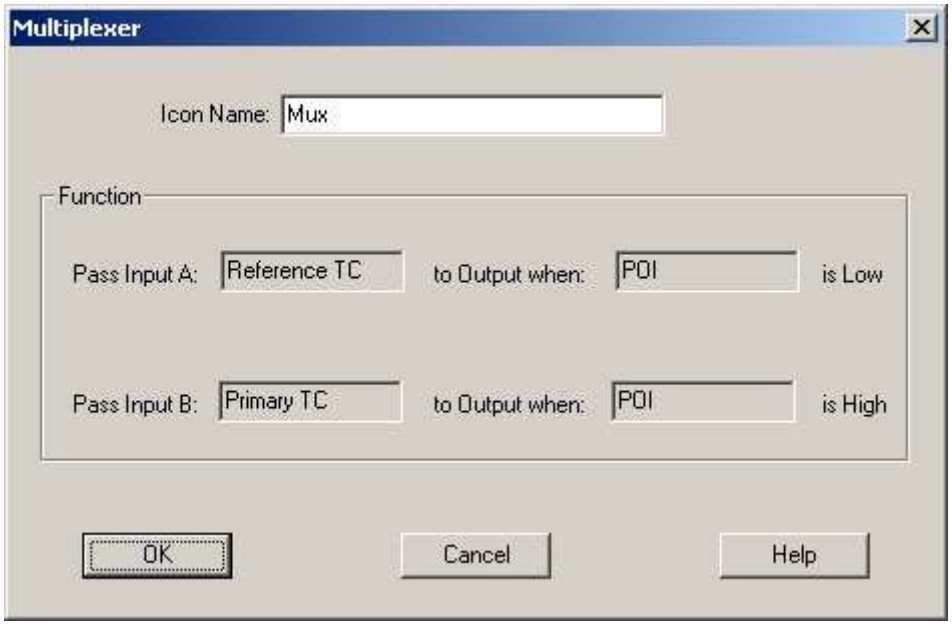
Select: Logic Control

Unlike the Trigger, this Control Input is state-driven. While the Select Input (POI) signal is LOW, the Multiplexer (Mux) icon output passes through the Signal from the upper Input (Reference TC). While the Select Input signal is HIGH, the

Multiplexer icon output passes through the Signal from the other Input (Primary TC).

Output: Analog Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Pass Input A:

This reflects the name (Reference TC) of the icon connected to this icon's upper Input Terminal.

Pass Input B:

This reflects the name (Primary TC) of the icon connected to this icon's lower Input Terminal.

To Output when _____ is Low/High:

This reflects the name (POI) of the icon connected to this icon's Select Control Terminal.

PERIODIC OUTPUT (POI) ICON

FUNCTION:

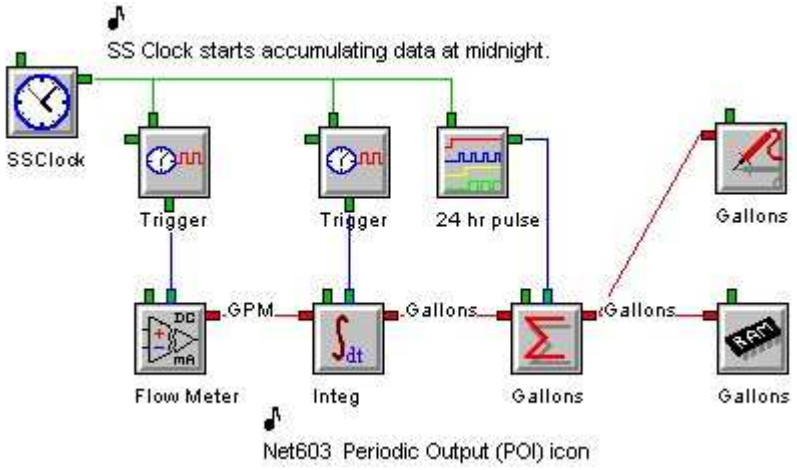
The Periodic Output Icon generates a Square Wave/Pulse Output based upon time values specified in its configuration dialog box.

EXAMPLE APPLICATION PROGRAM NET:

This is a good example of sampling data from an input at a fast rate while storing the data at a much slower rate. The 4-20mA output flow meter is being sampled every 1 second. The output of this icon is being fed into an Integral icon, which converts this flow rate (gallons per minute) into an actual amount which is updated every minute (based on the clock above the Integral icon).

The output from the Integral icon is in gallons, which is passed into a summation icon, whose job it is to total up the number of gallons that passed though the flow meter.

The information sent to memory is only stored one time every 24 hours, which is controlled by the POI (Periodic Output) icon. Once every 24 hours, the POI icon's output goes high for two seconds, enabling the summation icon's output to be stored to memory.



CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

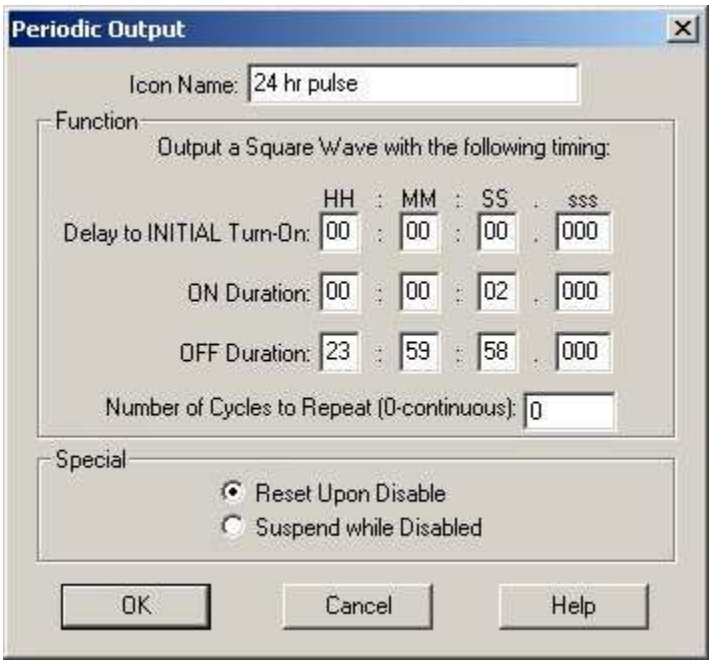
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:


Periodic Output
Icon Name: 24 hr pulse
Function
Output a Square Wave with the following timing:
HH : MM : SS . sss
Delay to INITIAL Turn-On: 00 : 00 : 00 . 000
ON Duration: 00 : 00 : 02 . 000
OFF Duration: 23 : 59 : 58 . 000
Number of Cycles to Repeat (0-continuous): 0
Special
Reset Upon Disable
Suspend while Disabled
OK
Cancel
Help

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

> **Note:** Time values are entered in hours (HH), minutes (MM), seconds (SS) and milliseconds (sss).

Delay to Initial Turn-On:

This is the amount of time after the Enable Input goes HIGH that the Output remains LOW. If the Enable pin is not connected, it is assumed to be HIGH (enabled). In this case, the Delay is the amount of delay after enabling the Logger itself.

On Duration:

This is the amount of time the Output remains HIGH during its cycle.

Off Duration:

This is the amount of time the Output remains LOW during its cycle.

Number of Cycles to Repeat:

This is the number of times that the specified cycle will repeat before stopping. Entering a value of zero will cause the cycle to repeat continuously.

> **NOTE:** The Delay to Initial Turn-On time is not repeated.

Reset Upon Disable:

Whenever this mode is selected, after the Enable Input goes from HIGH to LOW, the icon's state is reset. This means that the next time the Enable pin goes HIGH, the cycle starts from the beginning (including the Turn-On Delay).

Suspend While Disabled:

If this option is selected, whenever the Enable Input goes from HIGH to LOW, the icon's state is suspended. All timers are put on hold while the Enable input remains LOW. The next time the Enable goes HIGH, operation continues where it left off.

PROBE POINT (PP) ICON

FUNCTION:

Probe Point icons mark and provide access to nodes within a Program Net. They are used in various situations:

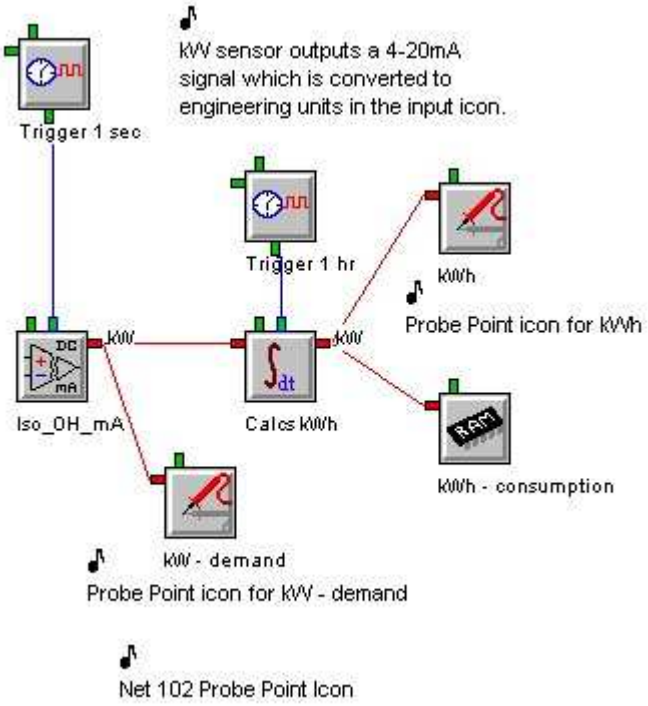
1. The Logger front panel display while the Program Net is executing. Values at the nodes can be accessed through the *Probe Point Values* LCD menu selection.
2. During *Real-Time Trending* sessions, nodes marked with Probe Point icons are accessible as long as HyperWare-II is connected to a Logger.
3. When HyperWare-II is connected to a logger, the *Quick Probes* dialog provides a convenient glance at the most recent values associated with these probes.
4. *GreenWater* can provide remote Trending when it connects to the Logger via Internet.

Probe Point icons inherit the Units value from the Outputs to which they are connected. These units will appear on the LCD display as well as when the Probe Point is used in Quick Probes. Real-Time Trending and GreenWater are illustrative representations, but also use the units label where appropriate.

EXAMPLE APPLICATION PROGRAM NET:

This program Net is an example of power monitoring from a kilowatt (kW) sensor. The sensor is read every 1-second. The output of this icon is sent to probe point (demand) and is also integrated over a one-hour period resulting in kWh. This kWh output from the Integral icon is also connected to a probe point (kWh) and is also stored to memory.

The two probe points may therefore be used to view the current demand values (is Kilowatts) or the total power used in kilowatt-hours (kWh).



CONNECTION TERMINALS:

Input: Logic or Analog Data.

The terminal will accept either signal type.

Enable: Logic Control

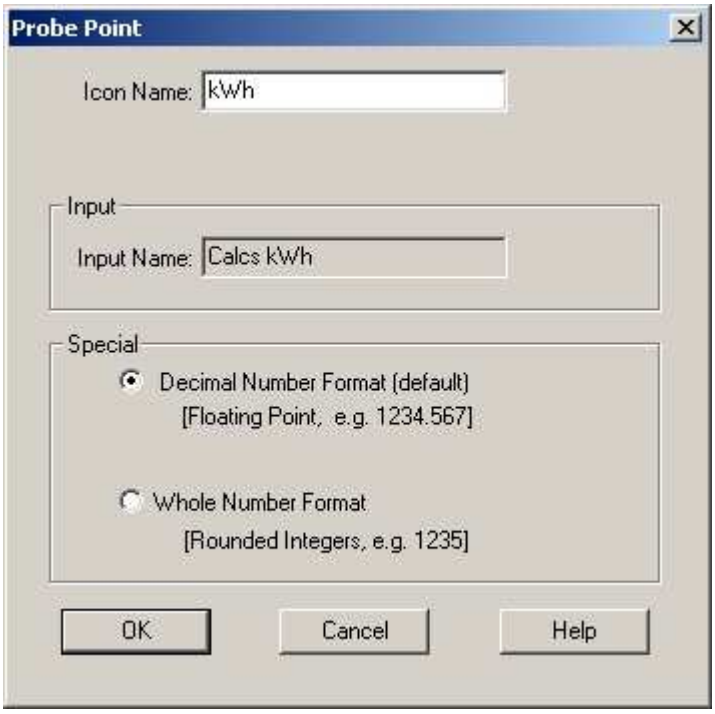
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output to displays only. No Output terminals are shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. By default, Probe Point icons will automatically take the name the icon connected to their input. This can later be changed to a unique name if needed.

Input Name:

This reflects the name (i.e. Calcs kWh) of the icon connected to this icon's Input Terminal

Decimal Number Format:

The data will displayed in Floating point format. This includes both the integer and decimal components (XXX.XXX).

Whole Number Format:

The data display will be rounded to Signed Integer format. This includes only the digits to the left of the decimal point (XXXXX.). For example, 123.4 would be shown as 123, but 4321.5 would be displayed as 4322.

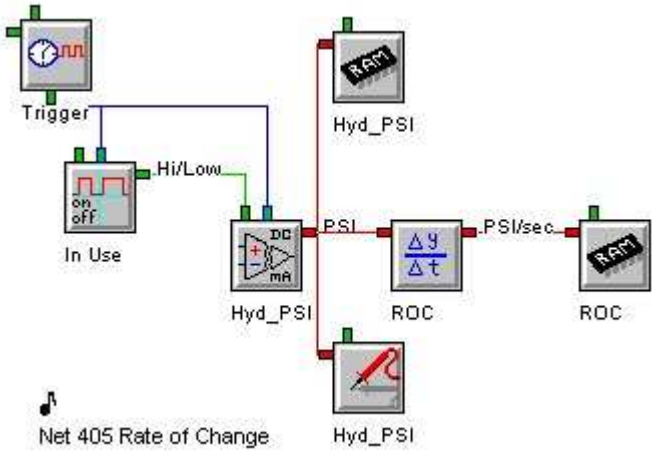
RATE OF CHANGE (ROC) ICON

FUNCTION:

The Rate of Change icon calculates and outputs the rate of change of a signal for a user-specified number of samples. A "sliding" calculation is performed each time the Input is updated. For example, if the user-entered number of samples is 5, after the 5th sample is taken, the 1st and 5th samples are used for the calculation. The next time sample is taken, the 2nd and 6th are used and so on.

EXAMPLE APPLICATION PROGRAM NET:

The manufacturer of Manlifts and Aerial Platforms is experiencing trouble in the field and suspect operators are attempting to lift the platform and arm faster than the design intends. To gather real world information they install a data logger to monitor the hydraulic pressure that operates the lift arm. They want to see how quickly the pressure builds to the lift arm and if it is within design parameters. They use a contact relay into the Digital Input (In Use) to enable the 4-20mA pressure transducer Input (Hyd_PSI) so that data is only gathered when the arm is in use. The pressure is scaled in the Input icon and then sent to the Rate of Change icon. This icon measures the Rate of Change over a span of readings (10) specified by the programmer. This way the Manlift manufacturer can tell how quickly the operators are telling the arm to move and take corrective action.



CONNECTION TERMINALS:

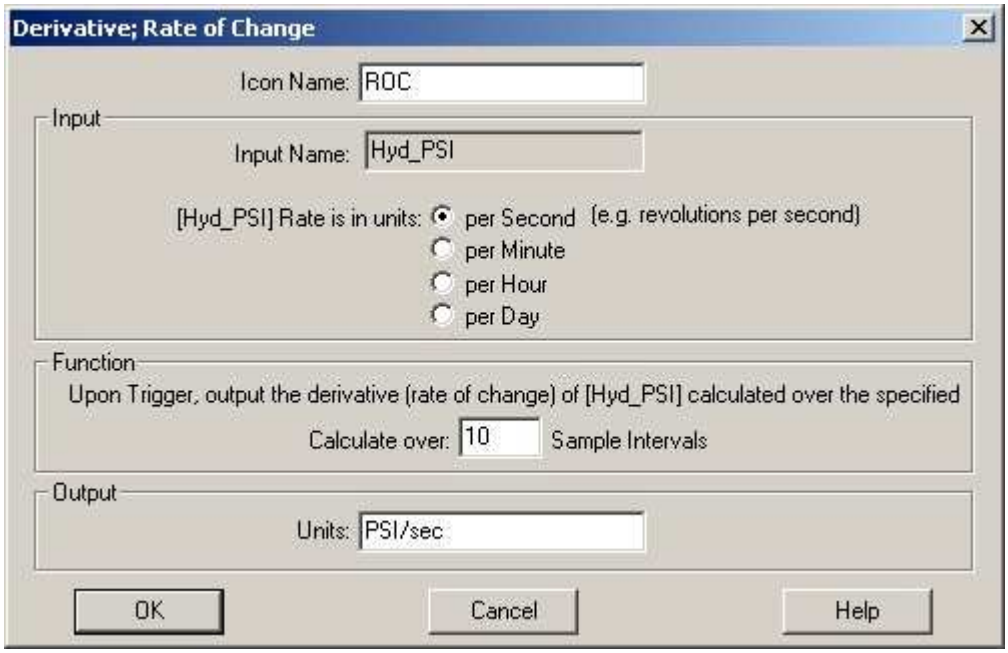
Input: Analog Data

> **Note**: This icon runs according to its input only. No Control Terminals are shown for icon connections in the Program Net.

Output: Analog Data

The Rate of Change icon updates its Output after receiving the user-specified number of samples and calculation the Rate of Change.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's Input Terminal.

Rate is in Units:

This option specifies the time base units (i.e. per second, per minute, etc.) for which the Input signal rate is specified. For example if Seconds is selected and the Input is temperature, the Output would be the rate of change of the Input in degrees per second. By providing this information, the Program Net will automatically calculate the correct Rate of Change.

If a time base other than seconds, minutes, hours, or days is used, the value being supplied into this icon can be scaled by a math icon prior to connection.

Calculate over _____ Sample Intervals:

This provides a text box for user entry of the number of samples. The number of samples implicitly defines the time interval used for the calculation.

Units:

Provides a text box for user entry of a Units label for the Output value.

REMOTE CONSTANT (VARIABLE) ICON

FUNCTION:

The Remote Constant icon has an Analog Output that can be controlled in real-time by the user. This Output can be connected to any Analog Input of another icon.

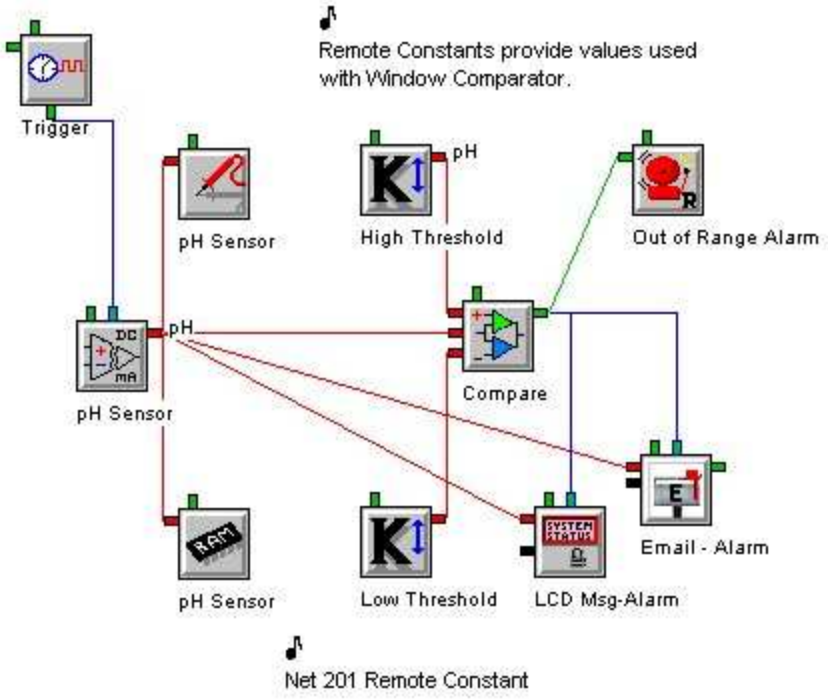
EXAMPLE APPLICATION PROGRAM NET:

This program monitors the pH of process waste water from an Orange Juice facility before it enters the sewer system. The process water is required by the City's Municipal Water District to be within a specified pH range, otherwise the facility must treat the water before it enters the municipal waste water system.

The pH sensor outputs a 4-20mA signal that is measured by the Input named pH Sensor. The mA DC Input icon also scales the 4-20mA signal to engineering units. The signal is sent to Memory and Probe icons as well as a Window Comparator icon.

Two Remote Constants define the "Window" for the Comparator. The pH needs to be regulated such that it falls within a narrow band as defined by the High Threshold and Low Threshold Remote Constant icons. When the measured value exceeds either value entered in the High or Low Threshold Remote Constant icons, the Comparator Output goes HIGH. This Logic signal causes a Relay Output to close, creating a local alarm. It also causes an LCD message to be displayed, indicating the pH value and causes an email to be sent with the out of range pH value.

The use of the Remote Constant icons allows the City Water District to remotely vary the values used to determine acceptable pH levels.



CONNECTION TERMINALS:

Note: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

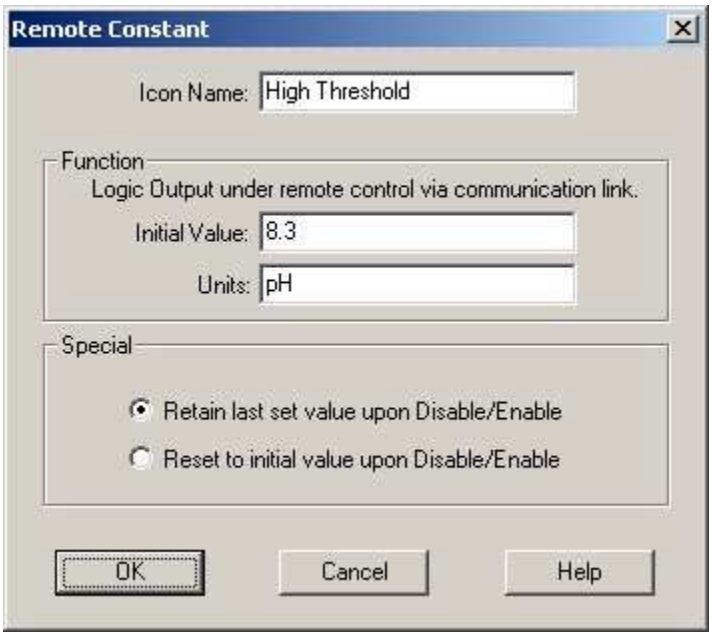
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

The Remote Constant icon updates its Output after receiving a user-generated command to do so from HyperWare-II.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Initial Value:

A user-defined value may be entered in this box. This will be the initial value used by the icon.

Units:

Provides a text box for user entry of a units label that will be shown at the Output from this icon.

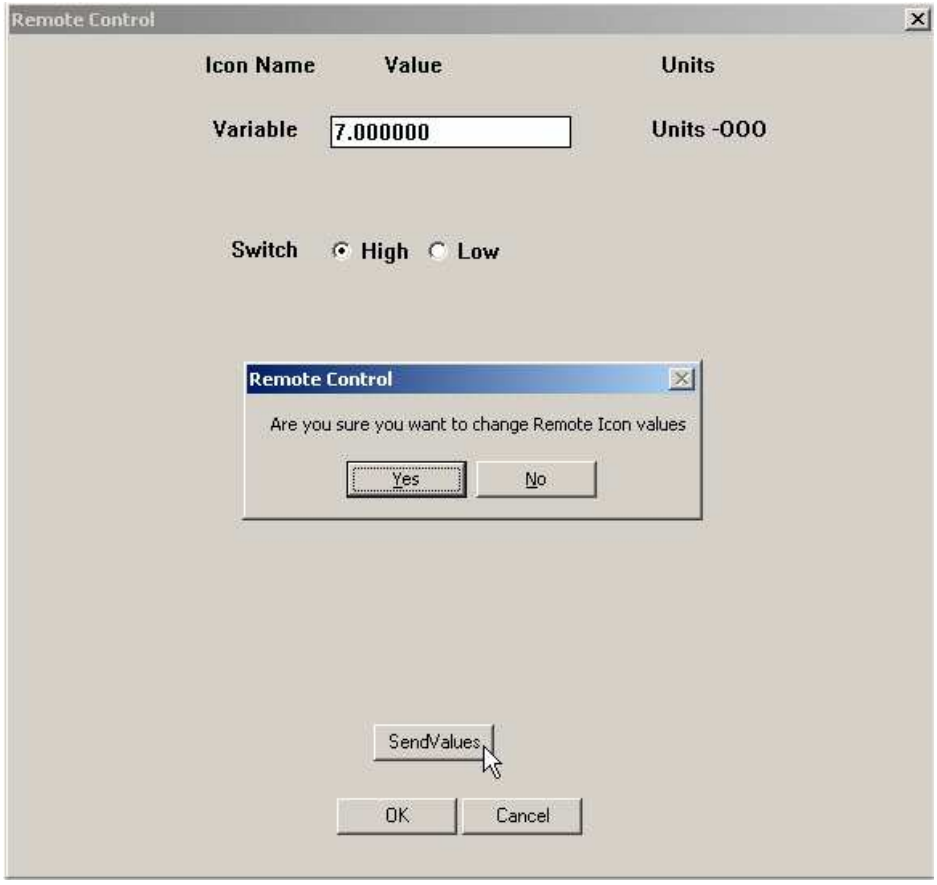
Special:

This parameter is ignored if the Enable Input is left Unconnected. Otherwise the transition form Disabled to Enabled will cause the icon to Output the value specified by the selected radio button: either the most recent value the icon was set to, or the Initial Value entered above.

Remote Control icons can be accessed from the Real-Time Trending Window. The button used to monitor or change the states of Remote Control icons is shown above.

Clicking this button will cause HyperWare-II to query the Logger for the names and corresponding states of its Remote Control icons. HyperWare-II will then display a dialog box such as the example below.

The state of each icon may then be changed. Clicking ***OK*** will cause HyperWare-II to send any updated values to the Logger.



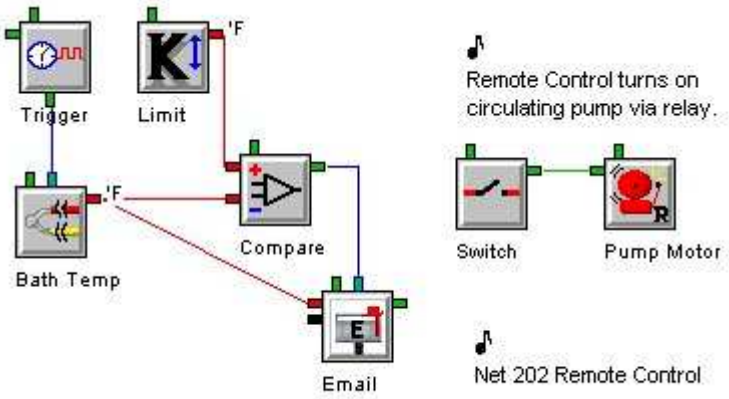
REMOTE CONTROL (SWITCH) ICON

FUNCTION:

The Remote Control icon has a Logic Output that can be controlled in real-time by the user. This Output can be connected to the Logic Input of any other icon.

EXAMPLE APPLICATION PROGRAM NET:

This program monitors the temperature of a plating bath. If the Bath Temp temperature exceeds the value entered in Limit icon then a warning email is sent to the operator. The operator will receive the email containing the current temperature on his cellular phone. By accessing the networked data logger from GreenWater or an Internet browser, the user can remotely turn on the circulation pump to cool the bath.



CONNECTION TERMINALS:

Note: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

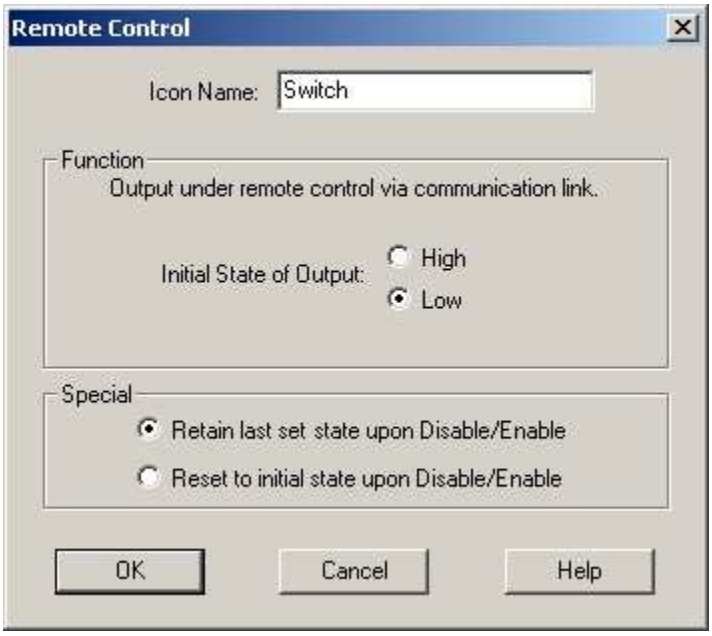
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

The Remote Control icon updates its Output after receiving a user-generated command to do so from HyperWare-II.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Initial State of Output:

This is used to specify the initial state of the icon's Output.

Special:

This parameter is ignored if the Enable Input is left Unconnected. Otherwise the transition form Disabled to Enabled will cause the icon to Output the state specified by the selected radio button: either the most recent value the icon was set to, or the Initial Value entered above.

R-S FLIP FLOP ICON

FUNCTION:

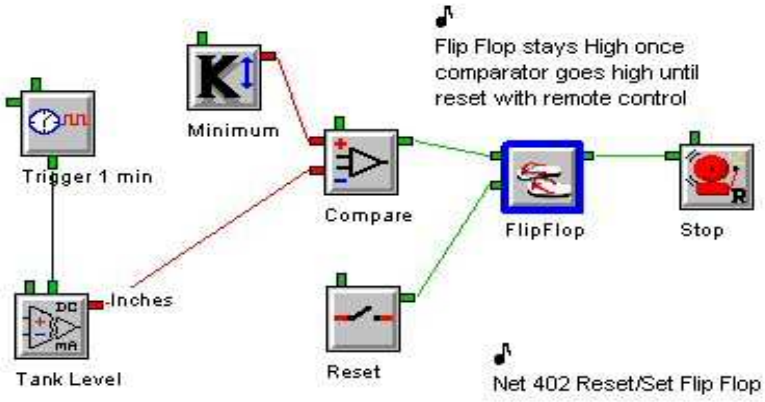
This icon operates as a latch, whose output goes high whenever its upper (Set) input goes high. The output will remain high until the lower (Reset) input goes high, at which time the output will return low.

EXAMPLE APPLICATION PROGRAM NET:

A paper and pulp manufacturer of cardboard cereal boxes needs to maintain a minimum level of sealing wax in the active holding tank. Anything less than the minimum should halt the continuous flow process.

Every minute the tank level is sampled and compared against the minimum acceptable level. If the level falls below the minimum, the output of the comparator goes high, forcing the Set input of the flip flop high, which will cause the output of the flip flop to latch high triggering the alarm.

The alarm will remain on until reset by the remote control switch when the tank has been refilled.



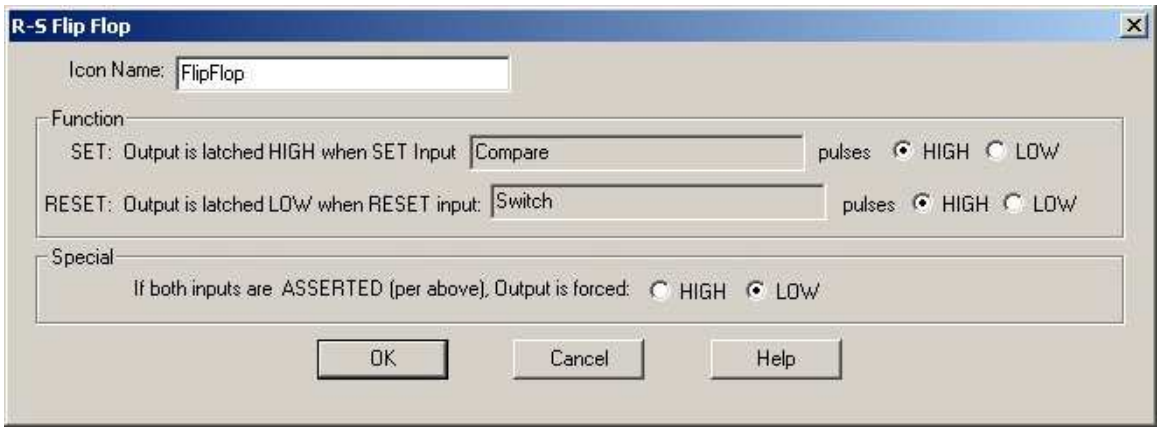
CONNECTION TERMINALS:

Inputs: Logic Data

> **Note**: Runs according to Inputs only. No Control Terminals are shown for icon connections in the Program Net.

Output: Logic Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

SET:

This reflects the name (i.e. Compare) of the icon connected to this icon's upper Input Terminal. The output will go HIGH when the SET Input changes to its selected state (High/Low). The output will then remain latched HIGH until the RESET condition is met.

> **Note**: When the *Special* condition is met, this overrides everything else. As the *Special* condition ends, the Inputs are re-evaluated, as if each just had a fresh transition.

RESET:

This reflects the name (i.e. Switch) of the icon connected to this icon's lower Input Terminal. The output will go LOW when the RESET Input changes to its selected state (High/Low). The Output will then remain latched LOW until the SET condition is met.

Special:

Whenever *BOTH* Inputs are asserted to their *selected* states, the Output will be forced to the state (High/Low) selected here, until at least one of the Inputs changes state.

SAMPLE RATE CLOCK (SRC) ICON

FUNCTION:

The Sample Rate Clock (SRC) icon generates Trigger Pulses used throughout Program Nets to set Sampling Rates of the different Input type icons. (The icon derives its clock rate from a Logger internal clock.)

When the Sample Rate Clock generates a Trigger Pulse, it causes the connected icons to read their Inputs, process the signal accordingly and then update their outputs. SRCs within a Program Net set the pace at which the various branches will sequence.

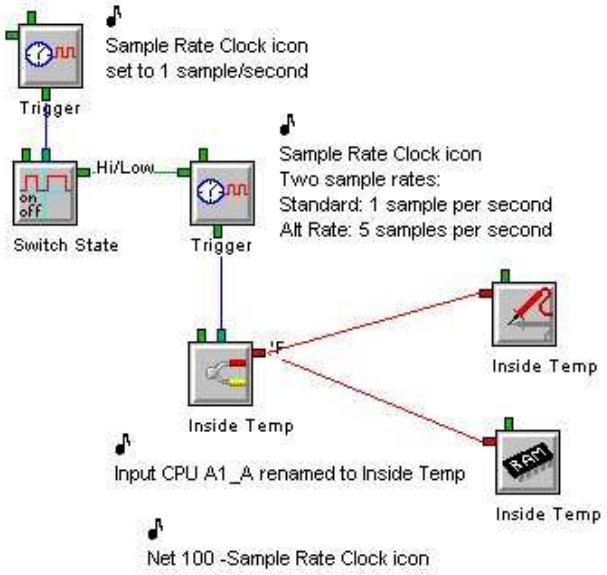
> **NOTE:** Every Program Net must have at least one Sample Rate Clock or POI to run correctly

Multiple Sample Rate Clocks may be used within a single Program Net to provide different sampling rates.

EXAMPLE APPLICATION PROGRAM NET:

The following example demonstrates the use of two Sample Rate Clocks in a simple Program Net. The application is a temperature monitoring process that requires a higher sample rate of temperature monitoring when an operator manually throws a switch. The switch is connected to the Digital Input icon, labeled Switch State, which is subsequently connected to the other Sample Rate Clock, which controls the Thermocouple Input icon. When the Switch State goes high (switch closed), the Alternate Rate of the second SRC will be used: 5 samples per second. When Switch State is Low (switch open), the standard Sample Rate is used, which is one sample per second.

The Output of the Thermocouple is then sent to a Probe Point icon for real-time viewing, and to a Memory icon.



CONNECTION TERMINALS:

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Alternate Rate Input: Logic data

The Sample Rate Clock has an *optional* Logic type (High / Low) Input Terminal that is used to control which of two clock rates will be output (see Configuration Dialog below).

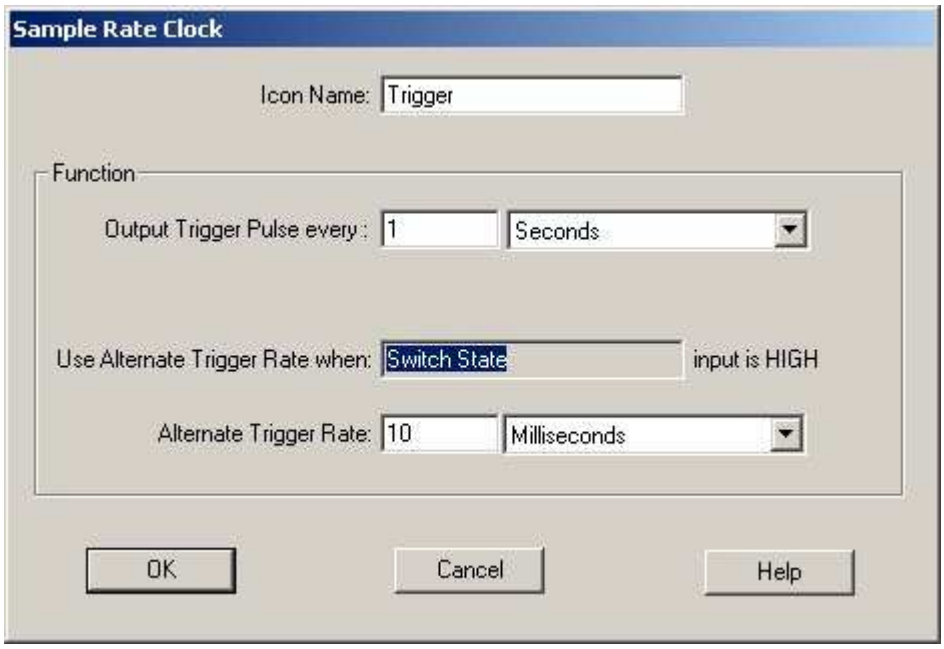
If the Alternate Rate Input is left unconnected, Trigger pulses will be output at the standard rate.

If this Terminal is connected to a Logic type (High / Low) Output from another icon (as shown in the second SRC in the Program Net above), the state of this signal will determine which of two rates will be used. When the Input signal is LOW, the standard Trigger Pulse rate will be output. When the Input is HIGH (in the Program Net above, when Switch State is HIGH), the faster Alternate Trigger Rate will be output.

Output: Trigger type

The Trigger Output Terminal of the Sample Rate Clock has a special function. The Logger ignores everything downstream of an SRC unless the Trigger Pulse is HIGH. So the SRC Trigger Output should always be connected to the Trigger Control Terminal (top middle) of an icon.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Output Trigger Pulse every:

A text box is provided for user entry of a number. The Units (milliseconds, seconds, minutes, hours, and days) can be specified via the drop-down list.

Use of the Millisecond setting will result in higher power consumption as the Logger microprocessor is continually running during this mode. If nothing in the Program Net is using the Millisecond setting, the microprocessor can be put to a low power `sleep' mode during times of inactivity.

> **NOTE:** With **MILLISECOND** Units, logging sessions must be limited to a ***maximum of 8 months***. This limitation holds for both Rotary and Log to Full Memory modes. This limit is due to a maximum time count that the Logger can internally store at the faster clock rate.
>
> For sessions ***longer than 8 months***, utilize **SECONDS** (or greater) Units.

Use Alternate Trigger Rate when _____ input is HIGH:

If the optional Alternate Rate Input is left unconnected, this will be grayed out.

When a Connection is made to the Alternate Rate Input, the Name (i.e. Switch State) of the icon connected to the Alternate Rate Input terminal displays. That name can only be changed in the other icon's dialog.

Alternate Trigger Rate:

If a Logic Terminal is connected to the Alternate Rate Input Terminal, the Alternate Trigger Rate settings are enabled. Enter the rate to be used when the Alternate Rate Input signal is High. A text box is provided for user entry of a number. The units (milliseconds, seconds, minutes, hours, and days) can be specified using the drop-down list.

SCHEDULER ICON

FUNCTION:

The Scheduler Icon has a Logic Output that is toggled High then Low based on a user-specified schedule. The icon can be used in a wide variety of applications where Program Net logic needs to be asserted or triggered based on a calendar or time-of-day type of schedule.

Examples include the following:

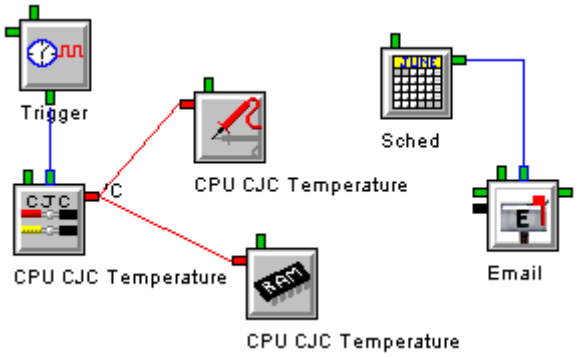
- Trigger an email at a specified time each day.
- Trigger an FTP of all stored data at a certain time on the 1st of every month.
- Turn on a relay for a short period every few hours.
- Connect the Scheduler Icon to the Trigger input of the Summation icon in order to generate weekly flow totals that are stored to Memory at midnight each Sunday.

EXAMPLE APPLICATION PROGRAM NET:

The following example demonstrates the use of a Scheduler Icon in a simple Program Net to email the daily temperature samples from the Logger's location to the Analyst.

The Sample Rate Clock (Trigger) Icon is configured to sample the CJC Temperature every one hour and record these values to Memory.

The Scheduler Icon is configured to output a trigger to the Email icon, resulting in the sending of an email containing the previous 24 hours samples to the Analyst at 2am each day.



CONNECTION TERMINALS:

Enable: Logic Control

Processing of icon is allowed:

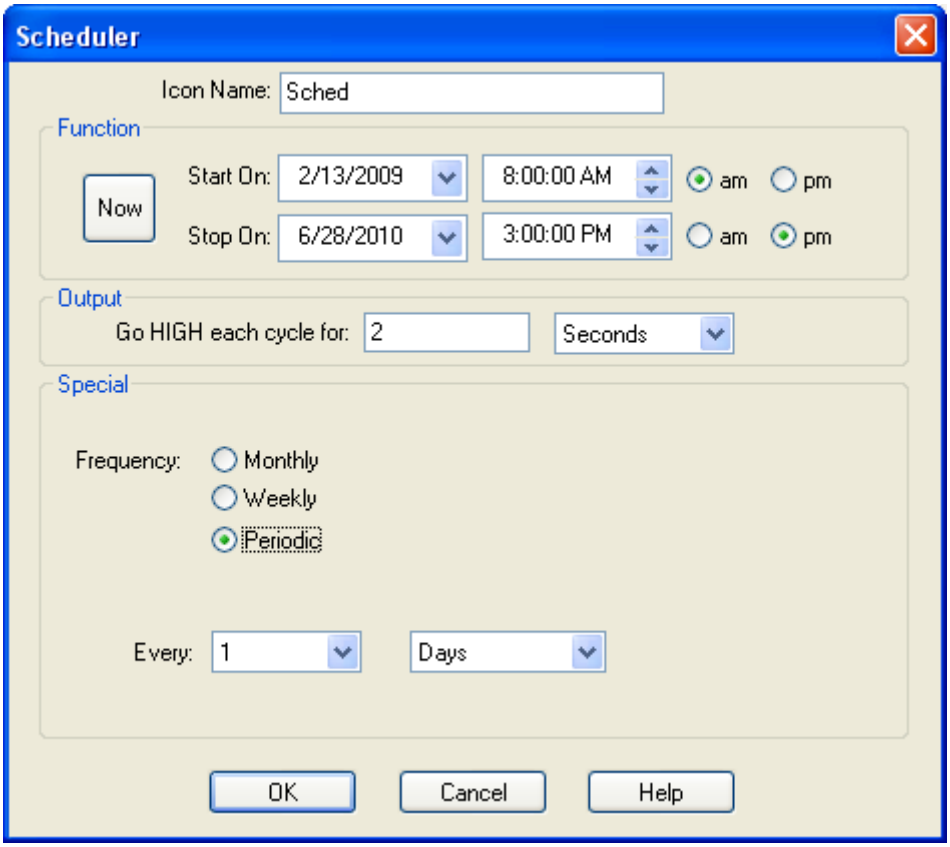
when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

The Output is HIGH then LOW based on a user-specified schedule.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Start On

The Start On time can be used for two different purposes:

1. Specification of the beginning of the time window within which the Scheduler Icon will operate. For example, if the Start On time is midnight on June 1st, 2008, and the Stop On time is midnight on July 1st, 2008, the Scheduler will only toggle its output during June 2008. Whenever the logger is enabled outside of the specified time window, the Scheduler icon will be idle.

   If, in this example, the Scheduler is set to Periodic mode, and set to "Every 1 Days". The output will go High every day of the month of June, 2008 at midnight because the Start On time is midnight. This is discussed further below.

2. To specify a repeating absolute time when the Scheduler Output will go High, for example every day at 3PM. The user simply wants the Scheduler to perform its function "all the time". In these situations the Start On time would be set to some time in the past and the Stop On time would be set far into the future. In these cases, the date portion of the Start On time is not important (as long as it is in the past).

However the time portion needs to be set to the time of day that the Output is to go High (3PM in this example). In this mode, every day at 3PM an Output Trigger would be generated for a duration of time specified in the “Go HIGH each cycle for:” field explained below.

Stop On

The calendar date/time when the scheduler icon will stop functioning.

> **Tip:** Clicking the **Now** button will reset both **Start On** and **Stop On** values to the current date and time.

Go HIGH each cycle for

These two fields (number and units of time) allow the selection of the amount of time that the output of the Scheduler Icon should go high when an activation time has been reached, as determined by the settings in the Frequency fields.

Frequency

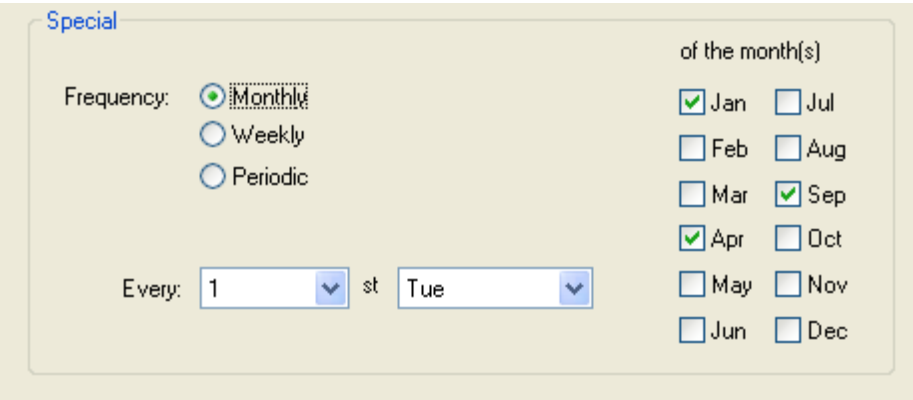
The frequency fields allow an extremely flexible selection of schedule, based on either a Monthly, Weekly or Periodic frequency.

PERIODIC

In the example Configuration Dialog shown above, a simple frequency of once per day has been selected, which will output a 2 second pulse. Of particular importance is the start time - this was set to a future date, with the start time of 2am, meaning that all activation times would be synchronized with 2am each day (the value of this might not be immediately obvious, but can be quite a useful function).

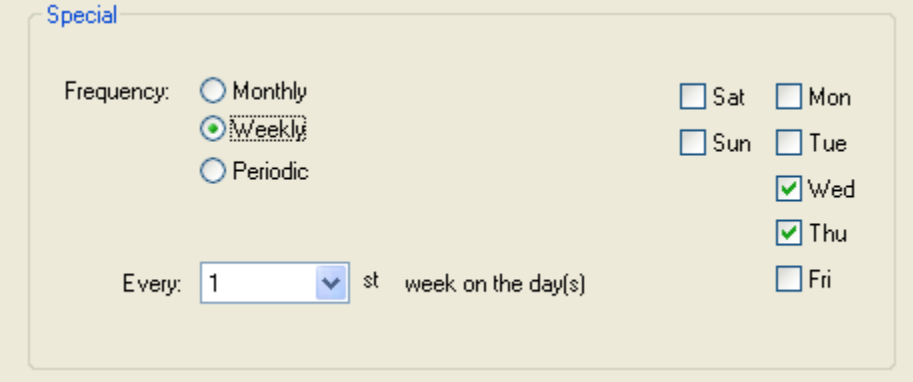
MONTHLY

As can be seen from these settings, the Scheduler has output Triggers configured for every first Tuesday in January, April and September.



WEEKLY

These settings are configured for every first week on Wednesdays and Thursdays.


Special
Frequency:
Monthly
Weekly
Periodic
Every:
1
st
week on the day(s)
Sat
Mon
Sun
Tue
Wed
Thu
Fri

START/STOP CLOCK ICON

FUNCTION:

The Start/Stop Clock icon generates a Logic Output that is a function of a user-defined time. Two different modes of operation are available, Absolute Start/Stop and Delayed Start/Stop.

Absolute Start/Stop Mode:

In this mode, the icon's Output is HIGH for a user-defined window of time. The user can specify the Start and Stop dates and times.

Delayed Start/Stop Mode:

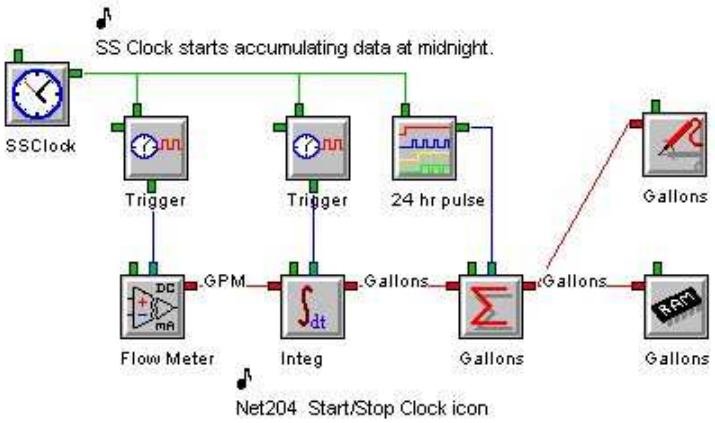
In this mode, the icon's output goes HIGH at a user-specified elapsed time after the Logger is enabled, then stays HIGH for a user-specified length of time before returning LOW.

> **NOTE:** In both modes, after the Start/Stop clock `stops', the Logger will continue to be enabled. However, any icons in the Program Net that are controlled by the Start/Stop icon will not update. Alarms will remain in the state they are in when the Stop occurs.

EXAMPLE APPLICATION PROGRAM NET:

An Irrigation District wants to record the number of gallons of water pumped from a river every day. A flow meter outputs a 4-20mA signal for flow rate. The mADC Input reads and converts the mA signal into Gallons Per Minute (GPM). The Time Integral icon integrates these values over a five-minute period. The Summation icon totals the flow until it is triggered to output the data from the Periodic Output icon named 24hr pulse.

In order to get data for one single day, the entire process begins with the Start/Stop Clock icon which enables the mA Input icon and the Periodic Output icon at midnight. The number of gallons pumped accumulates in the Summation icon for the entire day. When the Periodic Output icon triggers, data is sent to the Memory and Probe Point icons with total number of gallons for the day.



CONNECTION TERMINALS:

Note: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

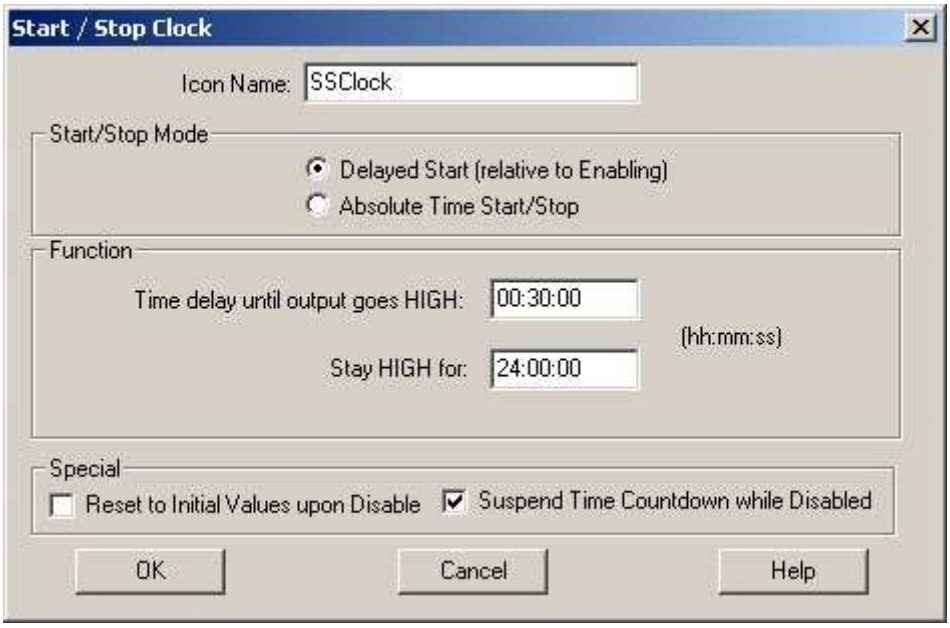
OR when connected *and* Enable signal is HIGH.

Output: Logic Data

The Output is HIGH during User-defined time windows.

CONFIGURATION DIALOG:

Start / Stop Clock
Icon Name: SSClock
Start/Stop Mode
Delayed Start (relative to Enabling)
Absolute Time Start/Stop
Function
Start on: 9/26/06 12:00:00 am pm
Now
Stop on: 10/ 4/06 12:00:01 am pm
October, 2006
Sun Mon Tue Wed Thu Fri Sat
24 25 26 27 28 29 30
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31 1 2 3 4
Today: 9/27/06
Cancel
Help



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Absolute Time Start / Stop:

The date can be entered via drop down calendar or manual entry. Spin controls are provided to increment each unit of time (hour, minute, second), or time can be entered manually.

START ON:
This is provided for entry of the date and time to turn the Output HIGH.

STOP ON:
This is provided for entry of the date and time to turn the Output LOW.

NOW:
Clicking this button sets both Start and Stop times to the current date and time.

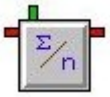
Delayed Start:

Times will be relative to the time that this icon is enabled. Times are manually entered in *hh:mm:ss* (hour, minute, second) format.

RESET TO INITIAL VALUES UPON DISABLE:
Checking this option will cause it to start from the beginning, each time the icon is re-enabled.

SUSPEND TIME COUNTDOWN WHILE DISABLED:
When *checked*, countdown only proceeds while the icon is Enabled, and the clock stops while disabled. If left *unchecked,* Elapsed time will be relative to the Enable.

STATISTICAL AVERAGE (AVG.) ICON



FUNCTION:

This calculates averages of data passing through the icon. The Average icon can function in two different modes as defined by the Function radio buttons.

Sample Count Average Output

The Average icon will accumulate a specified number of input samples then calculate the average of the accumulated samples and output the average result.

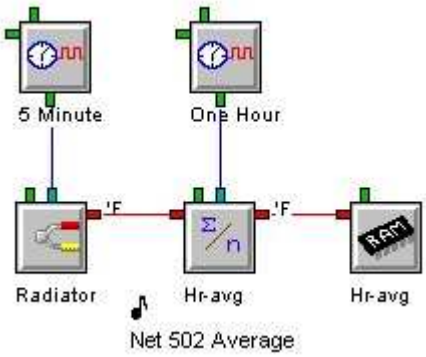
Triggered Average Output

A signal transitioning from LOW to HIGH on the Trigger terminal (terminal appears when this function is selected) will force the Average to be calculated from the accumulated samples and output.

Note: For a Sliding Average function, refer to the Smoothing Filter icon.

EXAMPLE APPLICATION PROGRAM NET:

In the following example Program Net, the Average icon is employed in the 'Triggered' mode. The Inlet temperature of a radiator is sampled every 5 minutes. An hourly average is desired so the Average icon's Trigger Input is connected to an hourly clock, resulting in an hourly average being stored to memory.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

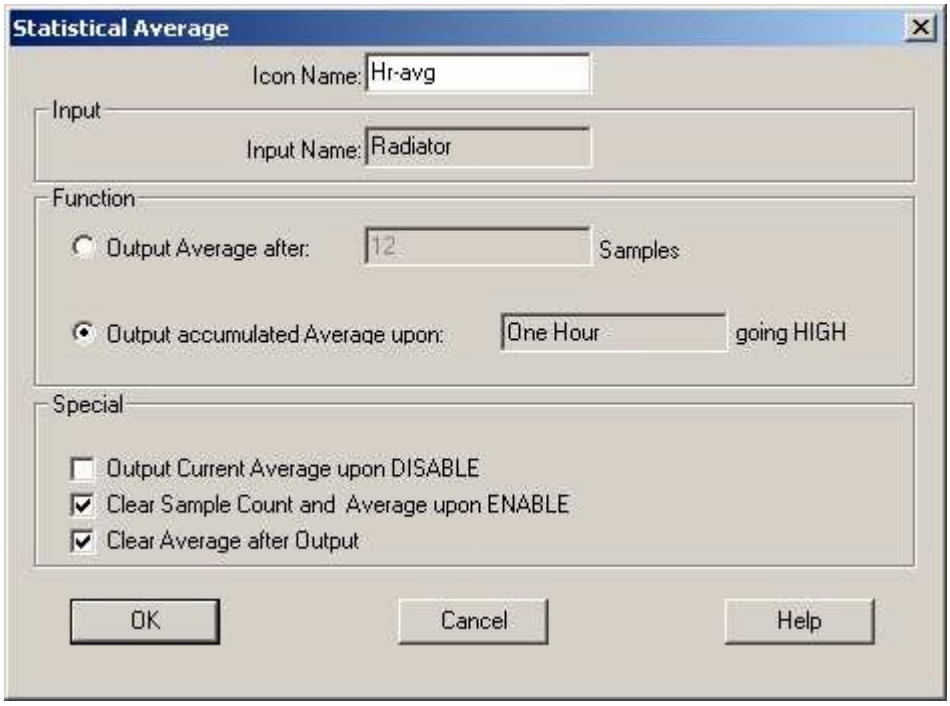
OR when connected *and* Enable signal is HIGH.

Trigger: Optional Logic Control

When 'Triggered' Mode is selected, an additional *Optional* Trigger terminal appears on the top of the icon. This forces output of the currently calculated average upon transition from LOW to HIGH.

Output: Analog Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name (i.e. Radiator) of the icon connected to this icon's Input Terminal

Output Average after:

If selected via the radio button, specify the number of samples to buffer up (accumulate) before the average is calculated and output. In the example above, averaging 12 samples at 5-minute intervals would be an alternate way to generate hourly Output.

Output accumulated Average upon:

If selected via the radio button, an additional Trigger terminal appears at the top of the icon. A signal transitioning from LOW to HIGH on this pin will force the Average to be calculated from the accumulated samples and output.

In the example above, a Sample Rate Clock icon (One-Hour) is connected to this Trigger Control Terminal to force an Average to be output every hour.

Output Current Average upon DISABLE:

Check this box to force an output of the in-process average calculation at any time that the icon is disabled. If this box is *not* checked, upon receipt of a disable signal, the Average calculation will be momentarily suspended until the icon is re-enabled and no in-process value will be output.

For example, if an average is to be calculated over 10 samples but only 7 have been averaged when the icon is disabled, the 7 sample average will be output and the Average calculation will be suspended until re-enabled. Upon re-enable, the calculation will continue and after 3 more samples are received, the 10 sample average will also be output (unless the following *Clear Sample Count…*check box is checked)

Clear Sample Count and Average upon Enable:

Check this box to force a reset of the Average calculation and the Sample count used for the calculation upon receipt of an Enable signal.

If this box is not checked, upon receipt of an Enable signal, the Average calculation will proceed from its suspended state (which it entered when it was disabled).

Clear Average after Output:

If checked, each time the Average is output, the accumulated average will be cleared and a new average calculation will start as new samples arrive.

If *not* checked, new samples will continually be added and calculated into the accumulating average.

STOP ICON

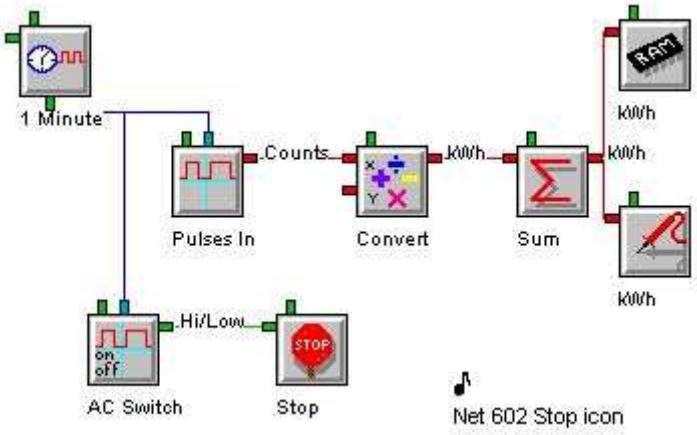
FUNCTION:

When the Stop Logging icon receives a Logic High Input, it stops the Logger execution of the Program Net. The function is the same as if the front panel STOP button was pressed.

EXAMPLE APPLICATION PROGRAM NET:

This is a power monitoring net that uses an AC current switch to monitor current flow in the circuit. The Pulses In Digital Input counts the pulses from a pulse output power sensing harness and converts the number of pulses to kWh in the Math icon. The kWh are summed for 15 minutes and then sent to memory and a Probe Point. The operator will be able to review energy consumption every 15 minutes in 15-minute increments.

The AC Switch digital input simply monitors an AC Current Switch that is on the same circuit as the power sensing harness. If current stops flowing the AC current switch will cause the output of the AC Switch Digital input to go high which will Stop the Logger by using the Stop icon.



CONNECTION TERMINALS:

Input: Logic Data

A HIGH signal on this Input Stops execution of the Logger Program Net.

Enable: Logic Control

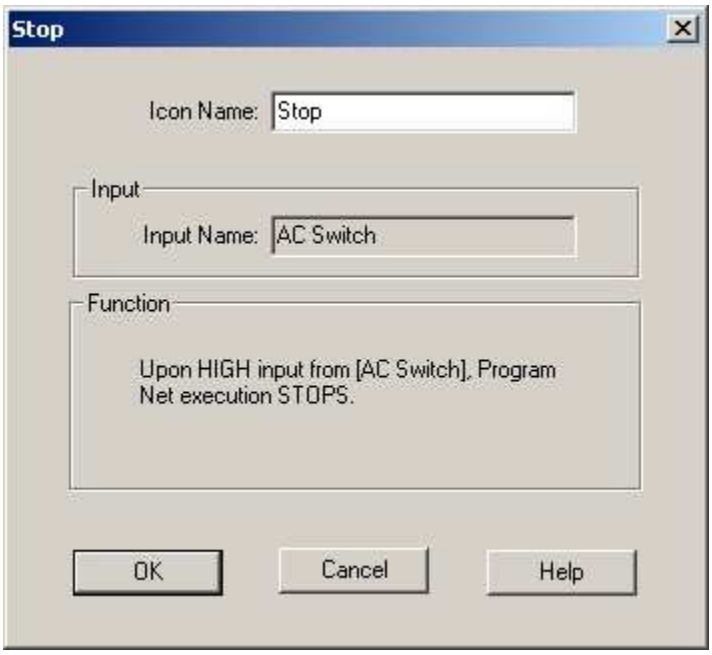
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Internal system control Output only. No Output terminal is shown on icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

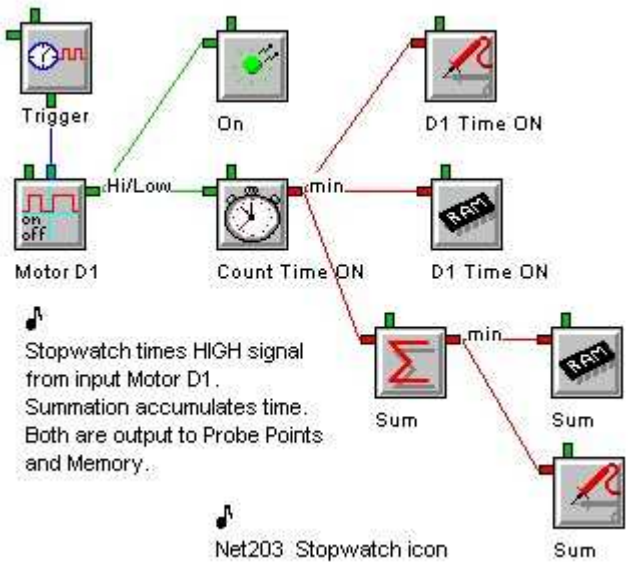
This reflects the name of the icon connected to this icon's Input Terminal.

STOPWATCH ICON

FUNCTION:

The Stopwatch icon measures the amount of time, in seconds, between a rising edge and a subsequent falling edge at its Input. When a rising edge is detected at its Input, the Stopwatch icon starts a timer. Upon receipt of a falling edge at its Input, the timer is stopped and time value is output.

EXAMPLE APPLICATION PROGRAM NET:



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

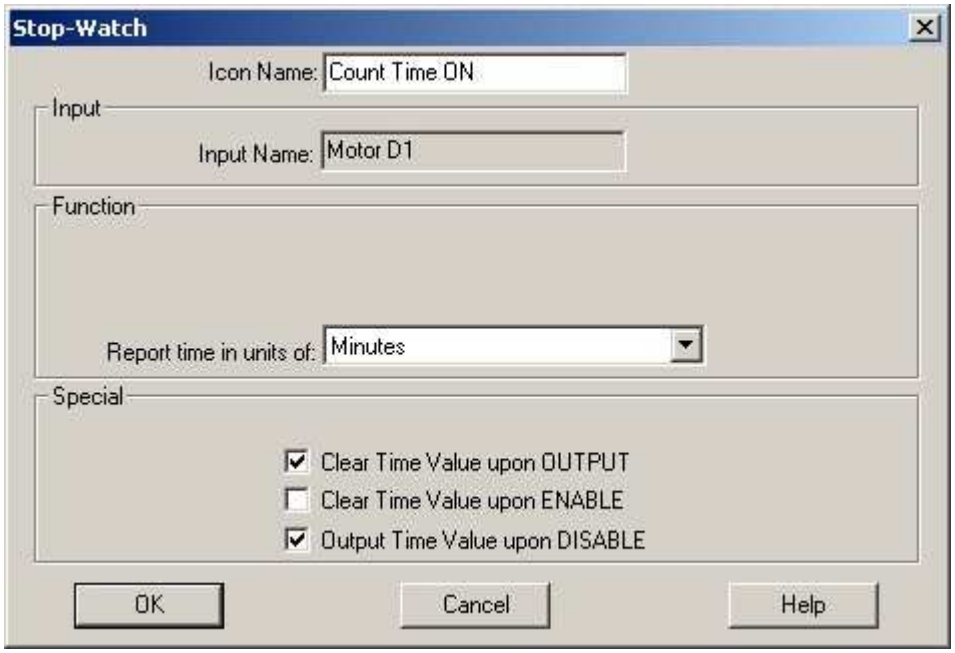
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Analog Data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name (i.e. Motor D1) of the icon connected to this icon's Input Terminal.

Report Time in units of:

The units (seconds, minutes, and hours) can be specified using the drop-down list.

Clear Time Value upon OUTPUT:

Check this box to force an erasure of the in-process time calculation at any time that the value is output (as Input goes LOW).

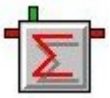
Clear Time Value upon ENABLE:

Check this box to force an erasure of the in-process time calculation at any time that the icon is enabled. If nothing is connected to the optional Enable Terminal, this will have no effect.

Output Time Value upon DISABLE:

Check this box to force an output of the in-process time calculation at any time that the icon is disabled. If this box is not checked, upon receipt of a disable signal, the time calculation will be momentarily suspended until the icon is re-enabled and no in-process value will be output.

SUMMATION ICON



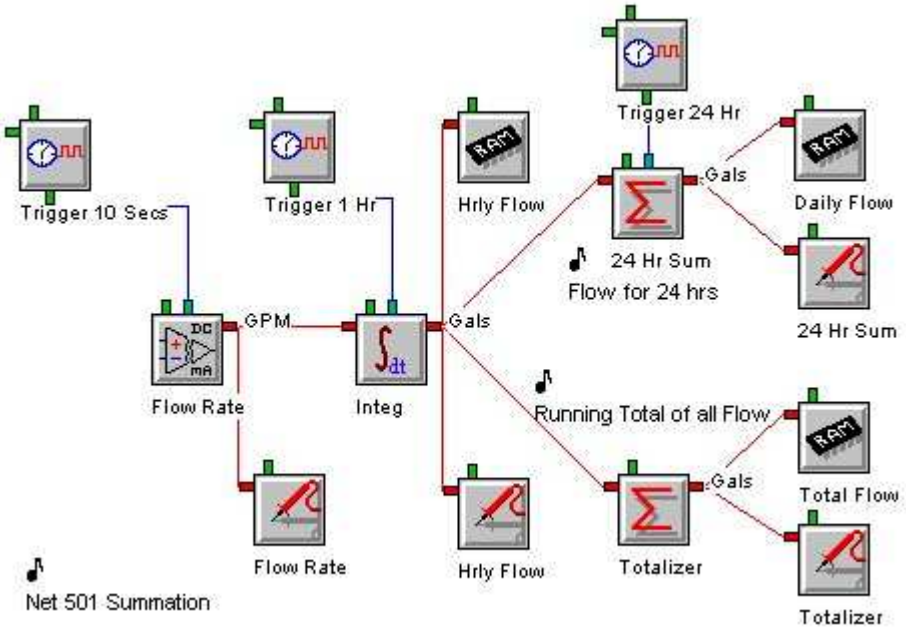
FUNCTION:

Sums the Input values received for a specified number of Input updates. The Summation icon will accumulate a specified number of input samples, then will calculate and output the arithmetic sum of this set of received Input values.

EXAMPLE APPLICATION PROGRAM NET:

A 4-20mA flow meter is connected to a milliAmp Input (Flow Rate) that converts the mA signal into a flow rate. The flow rate is measured every 10 seconds (Trigger 10 Secs) and the value Gallons Per Minute (GPM) is sent to a Time Integral icon (Integ) with a one hour Sample Rate Clock (Trigger 1 Hr). The Time Integral will integrate all the measured flow rates over one hour's time to output a volume in gallons over one hour. This value is stored in memory (Hrly Flow) and available for display on the LCD or web pages. The upper Summation icon (24 Hr Sum) totals the hourly values for a day and outputs the value to memory (Daily Flow). Its Trigger Control is connected to a 24 Hr clock, so the Daily Flow will be equal to one day or 24 hours. The Daily Flow total is not synchronized with the day, but could be synchronized with the use of a Start/Stop Clock icon initiating the two Sample Rate Clocks.

The other Summation icon (Totalizer) is configured not to clear data after Output. It is programmed to output data every 1 sample, so every hour it will output a value (Total Flow) which will be the running total flow. Memory and Probe Point icons allow for memory storage and real-time viewing, respectively.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

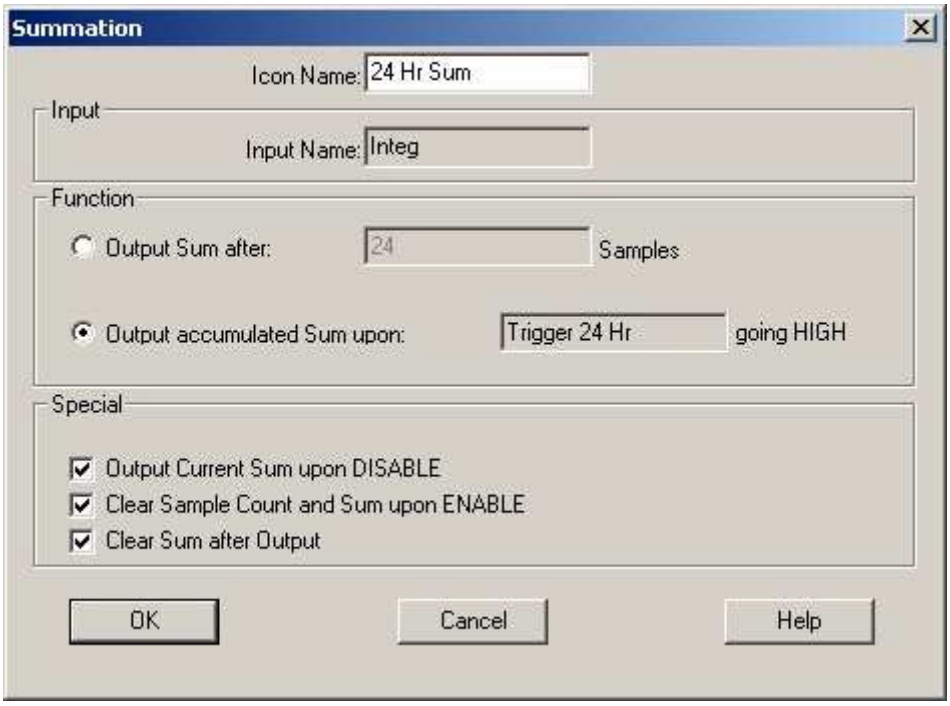
Trigger: Optional Logic Control

This Terminal only appears at the top of the icon if the 'Triggered' Function is selected. It specifies the time period over which the Input signal is summed.

Output: Analog Data

The Summation icon updates its Output with the arithmetic sum of the User-specified number of Input readings.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's Input Terminal.

Output Sum after _____ Samples:

Specify the number of Input readings to totalize before outputting the sum of the Input readings.

Output accumulated Sum upon _____ going HIGH:

When this radio button is selected, the *Optional* Trigger Terminal appears. After this Configuration Dialog is closed, another icon can be connected to the new Terminal. Then if the Configuration is re-opened by double clicking on the Summation icon, the associated text box will reflects the name of the icon connected to this icon's Trigger Terminal.

Output Current Sum upon Disable:

Check this box to force an output of the current Sum Value at any time that the icon is disabled. If this box is not checked, upon receipt of a disable signal, the Summation calculation will be momentarily suspended until the icon is re-enabled and no in-process value will be output.

For example, if a Sum is to be calculated over 10 samples but only 7 have been analyzed and the icon is disabled, the 7 sample Summation Value will be output and the Summing calculation will be suspended until re-enabled.

Upon re-enable, the summing will continue and after 3 more samples are received, the 10 sample Summation Value will be output (unless the following check box is checked)

Clear Sample Count and Sum upon Enable:

Check this box to force a reset of the Summation Value as well as the Sample count used for the calculation upon receipt of an Enable signal.

If this box is not checked, upon receipt of an Enable signal, the Summation calculation will proceed from its suspended state (that it entered when it was disabled).

Clear Sum after Output:

Check this box to force the Sum Value to be reset to 0 after Output. If this box is not checked, the icon will perform as a totalizer.

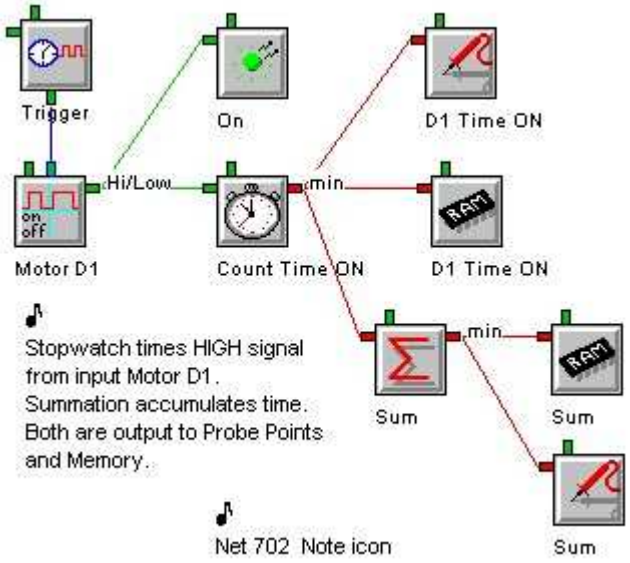
TEXT NOTE ICON

FUNCTION:

The Text Note icon provides a means to add user comments to a specific portion of a Program Net. Simply enter the text that is to be displayed.

EXAMPLE APPLICATION PROGRAM NET:

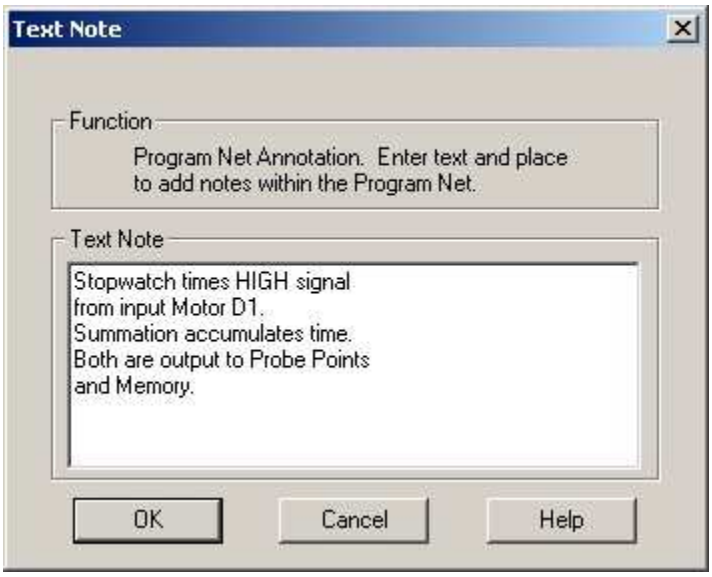
A power efficiency study group created a program to track the length of time an AC pump is on. An AC Current switch determines when the AC motor is operating, and the program can track and record for how long, when, and total operating time. When the motor is on, the AC Current switch is closed and the GPDI Digital input output transitions from Low to High. When High the Stopwatch counts the time and outputs this value to a Probe Point and Memory when the value goes low. The Summation icon totals the on times and outputs the accumulated on time whenever the AC motor is off.



CONNECTION TERMINALS:

Note: There are NO Terminals shown for icon connections in the Program Net for the Text Note icon.

CONFIGURATION DIALOG:



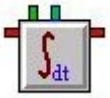
CONFIGURATION OPTIONS:

Text Note:

Simply enter the text that is to be displayed. The height and width adjust automatically, according to linefeeds (Enter/Return on keyboard).

Any text entered is purely for informational purposes when viewing or editing the Program Net. It has not impact on the performance of the Net while running.

TIME INTEGRAL ICON



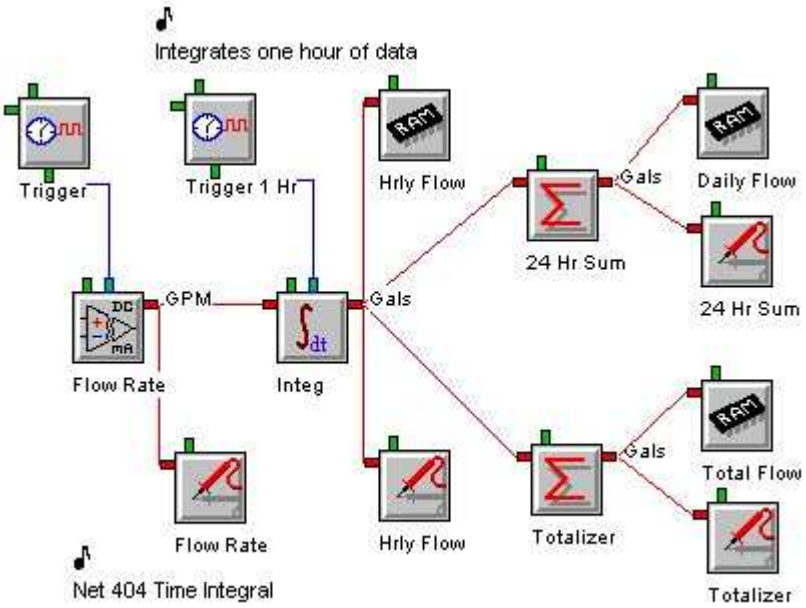
FUNCTION:

Calculates the time integral of data Input over a User-defined integration period. The Time Integral icon can only be used with Analog Data type Inputs.

Note: For LOGIC type Input time integration, refer to the Duty-Cycle icon.

EXAMPLE APPLICATION PROGRAM NET:

This is a simple flow example with a 4-20mA flow meter connected to an Input that converts the mA signal into a flow rate. The flow rate is measured every 10 seconds and the value Gallons Per Minute (GPM) is sent to a Time Integral icon with a one-hour Sample Rate Clock. The Time Integral will integrate all the measured flow rates over one hour's time to output a volume in gallons over one hour. This value is stored in memory and available for display on the LCD or web pages. Two summation icons that are configured for specific Outputs provide daily or 24 hour flow, and the Totalizer Summation icon keeps a running total for total flow. Both of these values are also sent to memory and Probe Points for display.



CONNECTION TERMINALS:

Input: Analog Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

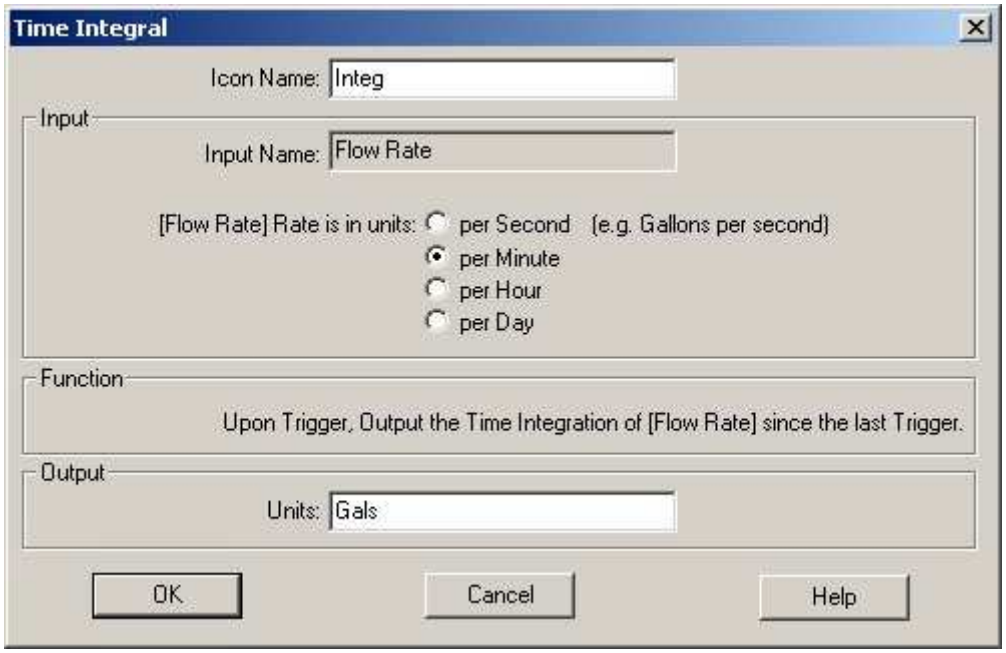
Trigger: Logic Control

This Terminal specifies the time period over which the Input signal is integrated.

Output: Analog Data

The Integral icon updates its Output with the new integral value after receiving a Trigger Pulse from the Trigger Control Terminal.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name (i.e. Flow Rate) of the icon connected to this icon's Input Terminal.

Rate is in Units:

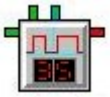
This is used to specify the time base (i.e. per second, per minute, etc.) for the input signal rate (Flow Rate). By providing this information, the Program Net will automatically calculate the correct unit volume Output based on the integration period. In the above example, Flow Rate was in gallons per minute (GPM), so per Minute is selected. With a 1 hour integration period specified by the user in a Sample Rate Clock icon (i.e. Trigger 1 Hr), the Logger will automatically generate the correct volume Output.

If a time base other than seconds, minutes, hours, or days is used, the input can be scaled by a math icon prior to connection to the Integral icon.

Units:

This provides a text box for entry of a Units label (i.e. Gals) for the Output value.

TIMED COUNTER ICON



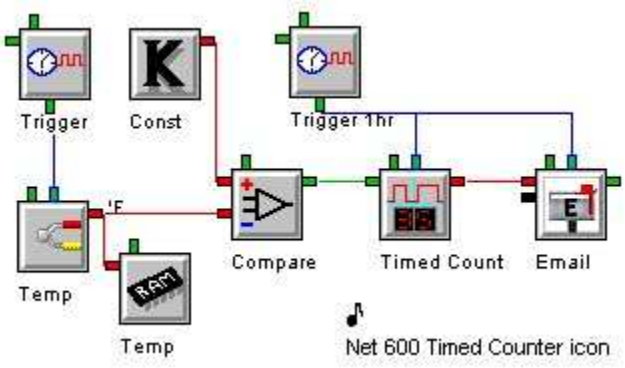
FUNCTION:

The Timed Counter is a software counter that can be used within a Program Net for accumulating transitions over a fixed period of time (for example: counting pulses received per hour). In concept, this icon performs a similar function as a hardware counter Input such as the GPDI in the Counter mode. However, the difference is that the Timed Counter is a software version that can be used to count transitions received from other software icons such as the Comparator.

EXAMPLE APPLICATION PROGRAM NET:

In a metal smelting operation a data logger is installed to monitor a gas temperature. An alarm condition exists if the gas in Pot 1 exceeds the critical temperature of 500F for more than 30 times in one hour. A Timed Counter will count the Comparator High excursions for one hour, and then output the value to an Email text message where the operator can view the number of over-temperature alarm excursions and take appropriate action.

A text message is programmed to be sent every hour on the 24-hour shift so that operators can confirm the system is working correctly.



CONNECTION TERMINALS:

Input: Logic Data

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

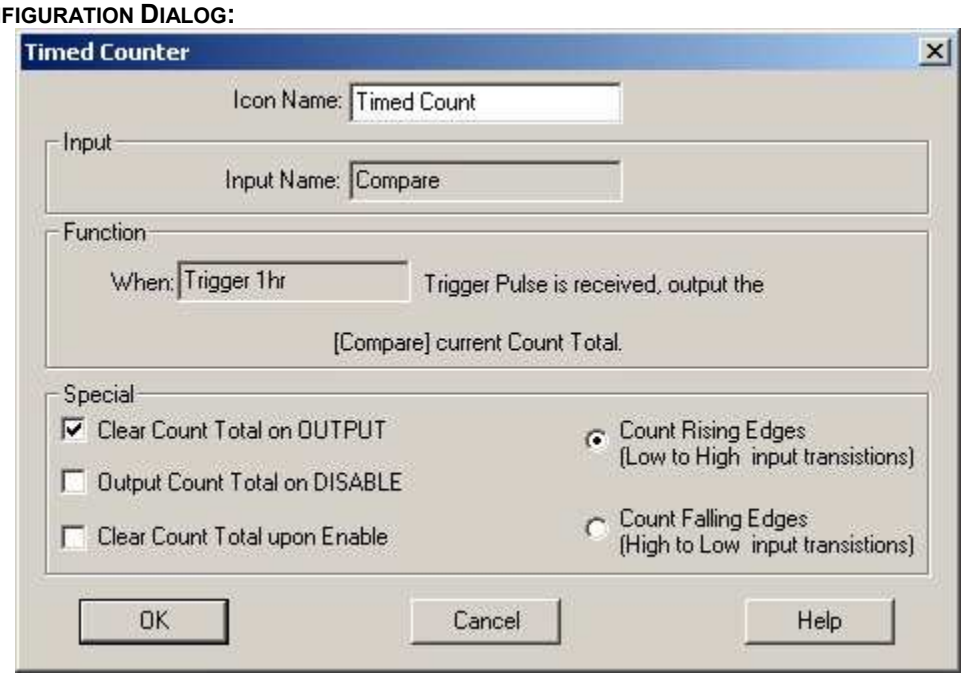
Trigger: Logic Control

Upon transition from LOW to HIGH, the signal from this Terminal forces the current count to be output, and counting resumes.

Output: Analog Data

The accumulated count is output.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Input Name:

This reflects the name of the icon connected to this icon's data Input Terminal.

When _____ Trigger Pulse is received:

This reflects the name of the icon connected to this icon's Trigger Control Terminal.

Clear Count Total on Output:

If this box is checked, after the accumulated count total is passed to the Output, the total will be cleared and counting will restart from 0. If the box is not checked, counting will be cumulative, adding on to the current total.

Output Count Total upon Disable:

Check this box to force an output of the accumulated Count at any time that the icon is disabled. If this box is not checked, upon receipt of a disable signal, the Counting function will be momentarily suspended until the icon is re-enabled and no in-process value will be output.

For example, if a Count is to be output when a one hour Trigger Pulse has been received but only 20 minutes have gone by and the icon is disabled, the 20

minute sample Count total will be output and the counting function will be suspended until re-enabled. Upon re-enable, counting will continue and after 40 more minutes, the hourly Count Total will be output (unless one of the other check boxes is checked).

Clear Count Total upon Enable:

Check this box to force a reset of the Count upon receipt of an enable signal.

If this box is not checked, upon receipt of an Enable signal, the accumulated Count will proceed from its suspended state (which it entered when it was disabled).

Count Rising Edges:

The Timed Counter increments its accumulated count when its Input changes state. Use this option to specify that LOW to HIGH transitions (edges) are to be counted.

Count Falling Edges:

The Timed Counter increments its accumulated count when its Input changes state. Use this option to specify that HIGH to LOW transitions (edges) are to be counted.

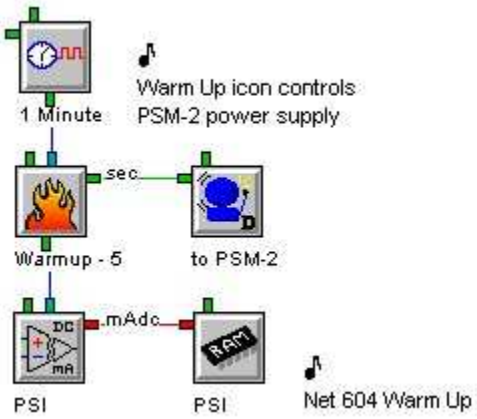
WARM-UP ICON

FUNCTION:

The Warm-up icon is a special icon, with two Output Terminals. It immediately outputs a logic signal on the normal Output Terminal (on the right) upon receipt of a Trigger Pulse. After a user-programmed delay, it passes the Trigger Pulse through its Trigger Output (on the bottom). The function of the Warm-Up icon is to turn on power to external sensors for a few seconds before the actual reading is taken from them, and then turn off power to extend battery life.

EXAMPLE APPLICATION PROGRAM NET:

This simple program is taking a pressure measurement every 1-minute using the Warm Up icon to control power to the sensor. The Sample Rate Clock is first connected to a Warm-Up icon, which turns on a low voltage control signal that subsequently turns a PSM-2 (Power Supply Module) output on. There is a 5-second delay before the reading is taken which allows the pressure transducer to stabilize. The 4-20mA signal from the pressure transducer is converted to engineering units (PSI) in the input icon then sent to memory.



CONNECTION TERMINALS:

Note: Trigger Input only. No Data Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Trigger Input: Logic Control

Upon transition from LOW to HIGH this Input forces the Warm-up icon to immediately set its Data Output HIGH when a Trigger Pulse is received. The Data Output remains HIGH until the User-defined time expires. Then a Trigger Pulse is output.

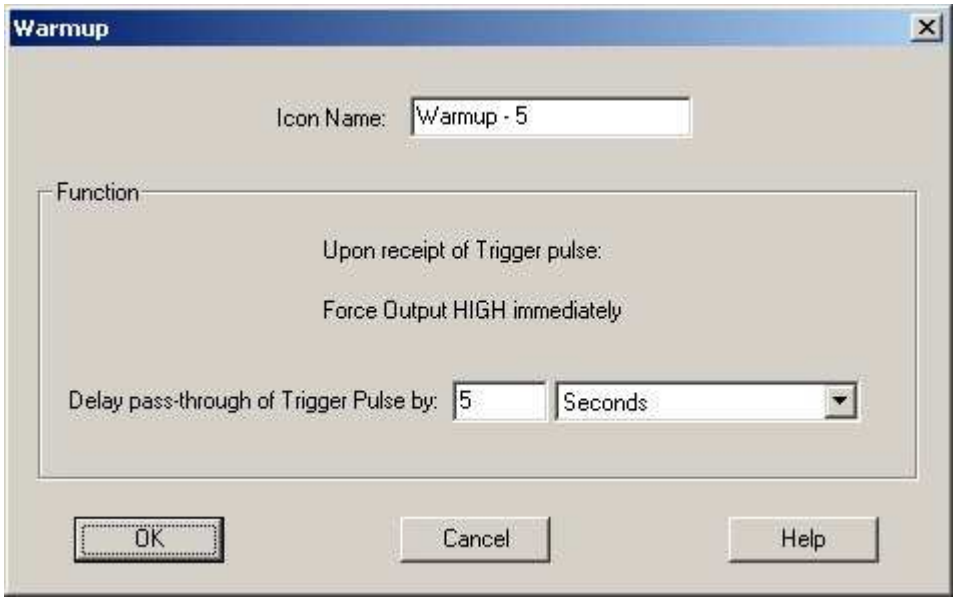
Data Output: Logic Data

The Logic Output goes HIGH and stays HIGH immediately after receipt of a Trigger Pulse.

Trigger Output: Logic Control

The Trigger Pulse is passed through the icon after a user-defined delay (warm-up time).

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Delay pass-through of Trigger Pulse by:

A text box is provided for User entry of a number. The Units (milliseconds, seconds, minutes, and hours) can be specified via the drop down list.

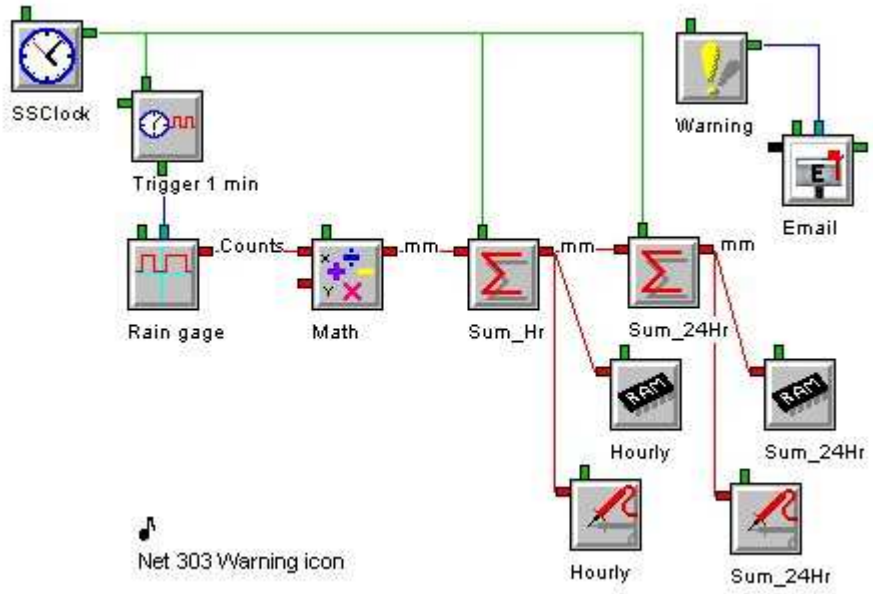
WARNING ICON

FUNCTION:

The Warning icon outputs a HIGH Logic signal while any of the user-selected system conditions are valid. When none of the conditions are valid, the output goes LOW. Multiple Warning icons may be used in a Program Net to initiate alarming or other actions upon different conditions. Some of the conditions may be cleared remotely from the menus of the LCD screen.

EXAMPLE APPLICATION PROGRAM NET:

A municipality has a number of rain gauges located around their city to collect city wide data for use in a rainwater run-off capacity study. Each rain gauge outputs a pulse for a certain amount of water. The Math icon converts these pulses to mm of water and its output is summed every hour and day using the Summation icons. The Start/Stop clock synchronizes the timing of the data. The Warning icon triggers the Email icon to send a data file and clear memory when memory is 80% full. This way the system is completely automated based upon memory used and there is no concern about filling memory and missing data.



CONNECTION TERMINALS:

Note: Internal system status only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

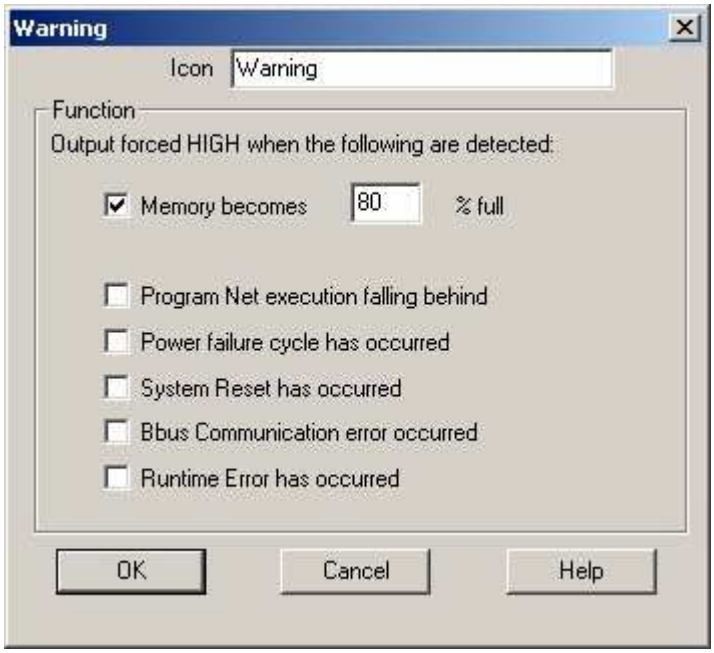
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic data

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Memory becomes ____ % full:

Output latches HIGH if Logger memory is filled to the specified percentage. 0% will cause it to go HIGH immediately. Anything over 100% will go HIGH as soon as memory is full. If memory fails (i.e. CF card removed without stopping session), the output will go HIGH.

This condition is set LOW when Memory is cleared. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

Program Net execution falling behind:

Output latches HIGH if a sample is missed (i.e. not taken at the Sample Rate Clock commanded time) during execution of a Program Net. This can occur if a Program Net requires more time to process than the user has specified via Sample Rate Clock Trigger rates.

Note: missing a sample does not cause the Program Net to stop.

This condition is set LOW at start of new session, or when cleared remotely by the user. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

Power Failure cycle has occurred:

A Power Failure occurs when the Logger power supply voltage falls below a useable level. If this occurs, the Logger stops execution of the Program Net, preserves data memory, and sets a memory marker (flag) that indicates that a Power Failure has occurred.

When the power to the Logger returns, the Warning icon Output latches HIGH indicating that a Power Failure has occurred, and the Logger will automatically resume execution of the Program Net however the icon Output will remain HIGH.

This condition is set LOW when cleared remotely by User. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

> **Note:** For warning of *impending* power failure, use the battery and alarm icons.

System Reset has occurred:

If a System RESET occurs, the Output latches HIGH. The Watch-Dog Timer or a front panel RESET can cause a System RESET to occur.

This condition is set LOW at power on or when cleared remotely by the user. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

BBus Communication error has occurred:

If a Communication error occurs across the blue BBUS cable, the Output latches HIGH. Possible causes include DIP switches no longer matching the net, or an altered board address.

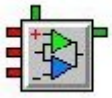
This condition is set LOW at the start of a new session or when cleared remotely by the user. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

Runtime Error has occurred:

If a Runtime Error occurs, the Output latches HIGH. Runtime errors should normally not occur, but could be caused by a corrupted Program Net in the Logger's memory. A Runtime error could also be caused by incompatible Logger and Hyperware-II versions.

This condition is set LOW at the start of a new session or when cleared remotely by User. If all other selected conditions are LOW, the Output of the Warning icon will then go LOW.

WINDOW COMPARATOR ICON



FUNCTION:

The Window Comparator icon checks if the input lies within a 'window' bounded by two other inputs called *High* and *Low Thresholds*. If the input lies in the 'window' between the High and Low Inputs, the Output is forced to the user-defined 'between thresholds' Logic State. If the input is outside the 'window' the Output is forced to the opposite state.

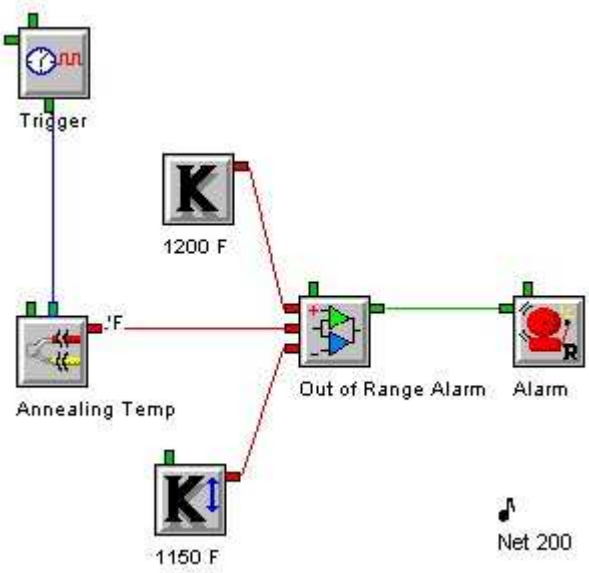
The High and Low Threshold Inputs are defined by their Program Net connections. For fixed window comparisons these Threshold Inputs might connect to Constant icons (which provide a fixed numerical value).

Hysteresis can be enabled and defined by the user to prevent oscillation as the Input passes through a window-bounding threshold.

EXAMPLE APPLICATION PROGRAM NET:

In the following example, it is desired to output an alarm if an annealing oven temperature (measured by a thermocouple Input) wanders out of the desired temperature window of 1150 to 1200 degrees Fahrenheit. The window is defined by the two Constant icons, which have been assigned these numerical values. The Window Comparator is configured to output a HIGH signal if the Annealing Temperature exceeds the High Threshold or falls below the Low Threshold. A HIGH Output turns the Alarm icons ON.

Note the use of the Remote Control Constant for the Low Threshold in this example that allows for user adjustment of the threshold while the Program Net is executing.



CONNECTION TERMINALS:

Inputs: Analog data

High Threshold, Low Threshold and Signal Input are all required.

Enable: Logic Control

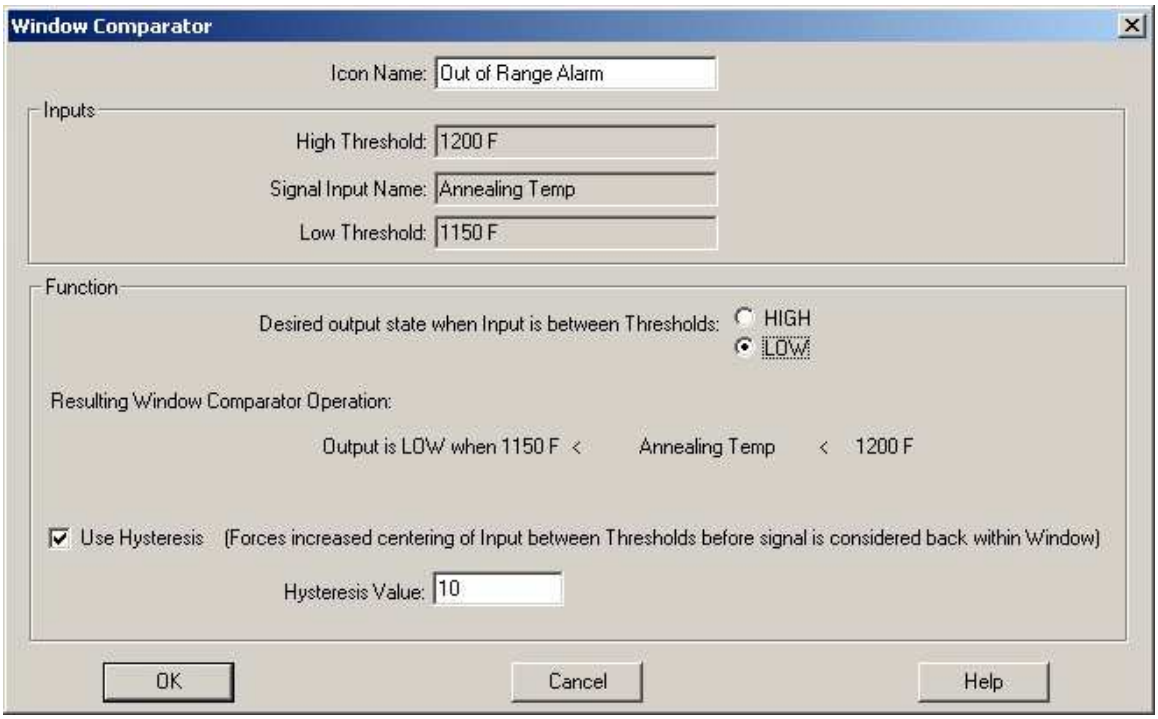
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Output: Logic Data

CONFIGURATION DIALOG:


Window Comparator
Icon Name: Out of Range Alarm
Inputs
High Threshold: 1200 F
Signal Input Name: Annealing Temp
Low Threshold: 1150 F
Function
Desired output state when Input is between Thresholds:
HIGH
LOW
Resulting Window Comparator Operation:
Output is LOW when 1150 F < Annealing Temp < 1200 F
Use Hysteresis (Forces increased centering of Input between Thresholds before signal is considered back within Window)
Hysteresis Value: 10
OK
Cancel
Help

CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

Inputs:

Note that none of these three settings are set by the user from within this dialog… they merely reflect names of icons connected to these Input Terminals.

HIGH THRESHOLD:
Reflects the name (i.e. 1200 F) of the icon currently connected to the High Threshold input terminal. This Input sets the upper boundary for the window comparison.

SIGNAL INPUT NAME:
Reflects the name (i.e. Annealing Temp) of the icon currently connected to the Input (center) terminal. This Input signal is compared to the High and Low Threshold Inputs' values.

LOW THRESHOLD:
Reflects the name (i.e. 1150 F) of the icon currently connected to the Low Threshold Input Terminal. This Input sets the Lower boundary for the window comparison.

Function:

Specify the desired logical state for the Output when the Input is between the High and Low Thresholds.

The *Resulting Window Comparator Operation* states how the Window Comparator will operate based on the current connections and User-specified settings.

USE HYSTERESIS:
Checking this box and entering a Hysteresis value applies Hysteresis to both switching threshold levels. The following diagrams illustrate operation with and without Hysteresis:

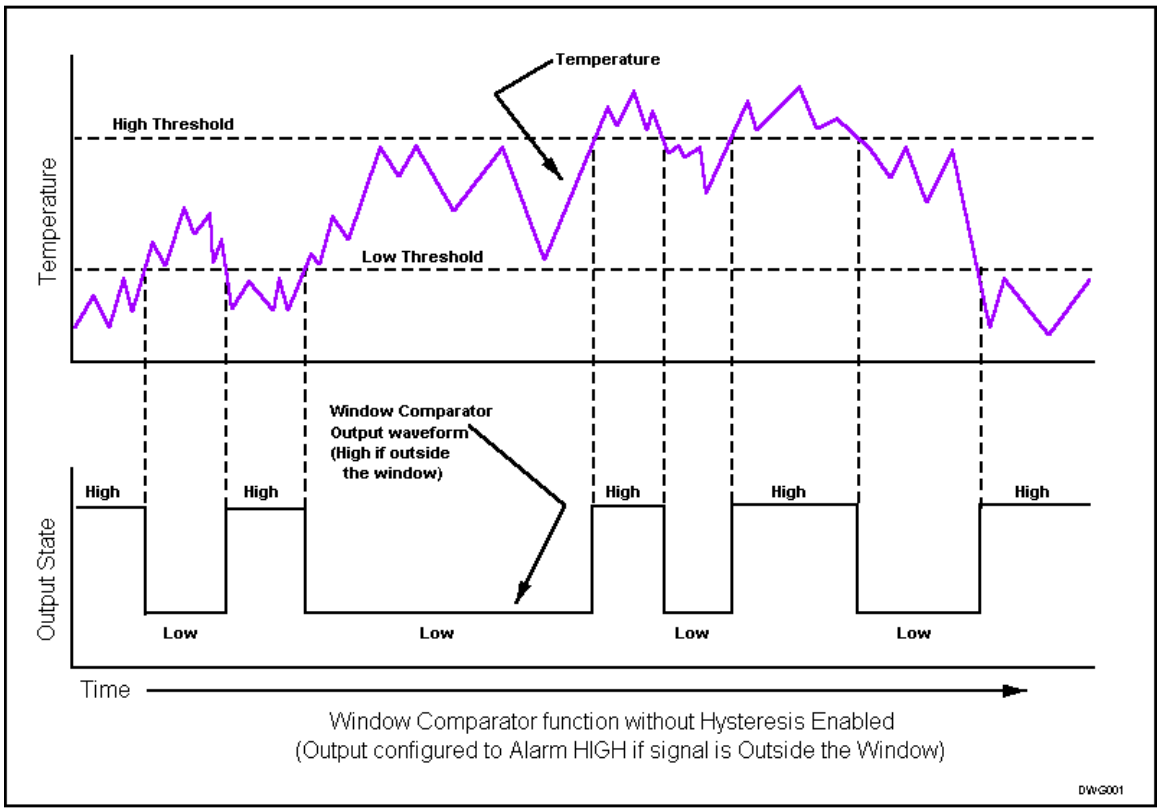


Figure 14-2; Window Comparator without Hysteresis Enabled

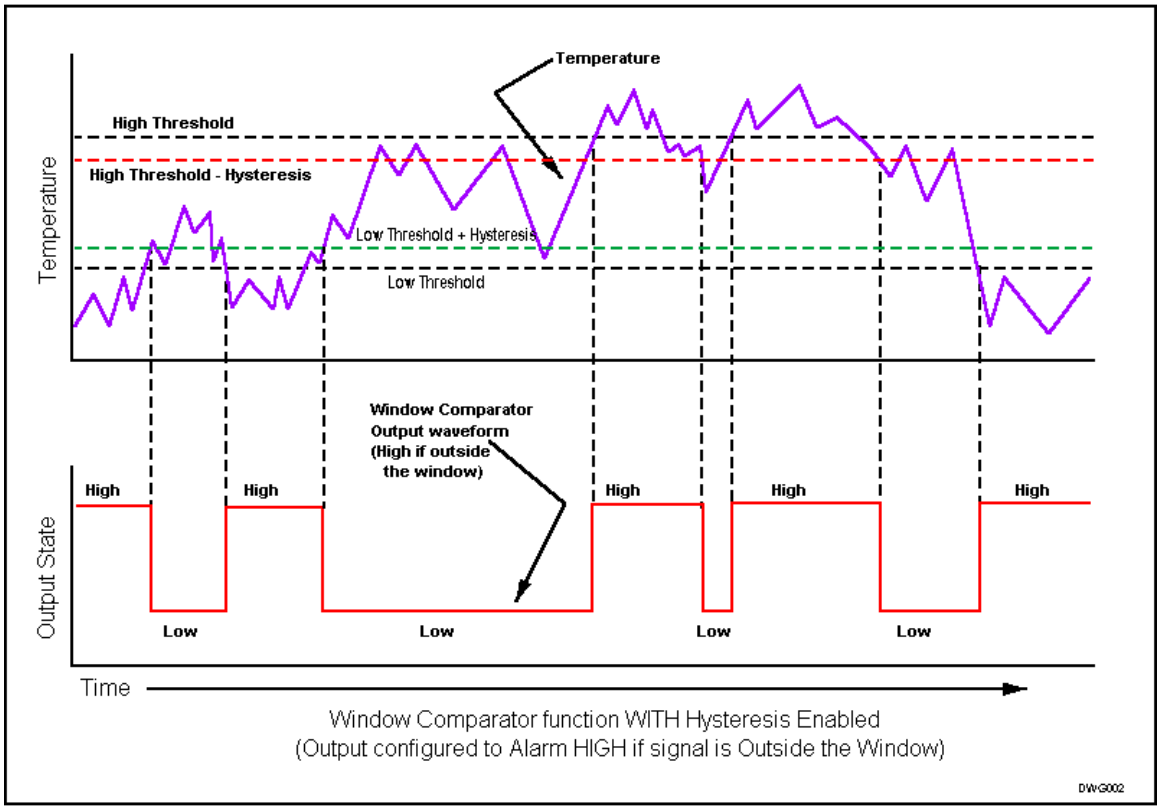


Figure 14-3; Window Comparator Operation <u>with</u> Hysteresis Enabled

15 APPENDIX B: SYSTEM BASE ICON REFERENCE

+5VDC OUTPUT ICON

FUNCTION:

Only one five volt Output is provided as an integral part of the CPU. The +5Vdc Output icon provides software access to this Output.

CONNECTION TERMINALS:

Input: Logic Data.

Enable: Logic Control

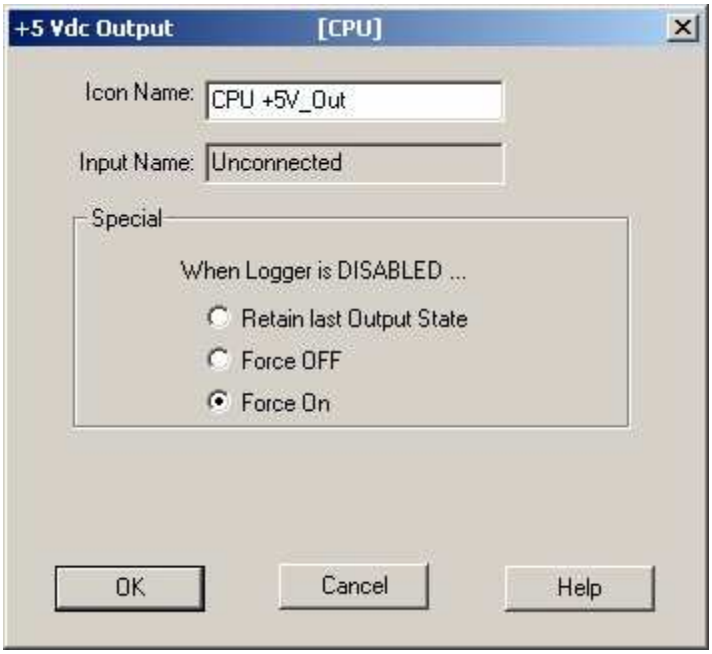
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output only. No Output terminal is shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name will be CPU +5V_Out.

Input Name:

This reflects the name (i.e. Unconnected) of the icon connected to the +5Vdc Output icon's Input Terminal.

Retain last Output State:

Selecting this option will prevent the output from changing state when the Logger is stopped.

Force OFF:

Selecting this option will force the output signal to go LOW when the Logger is stopped.

Force On:

Selecting this option will force the output signal to go HIGH when the Logger is stopped.

ANALOG OUTPUT (DAC) ICON

FUNCTION:

Two channels of Analog Output are provided on the CPU. The Analog Output icons provide software access to these outputs.

These analog outputs can provide between 0 and +10 volts DC out, corresponding to the value applied to their input terminal. For example, a value of 8.5 applied to the input terminal will cause 8.5v to be applied to the output terminals.

Note that the voltage assigned to these outputs cannot exceed the supply voltage of the Logger, so in order to reach the maximum potential of +10v at the output, the Logger supply must be greater than 10 volts.

CONNECTION TERMINALS:

Input: Analog Data.

Enable: Logic Control

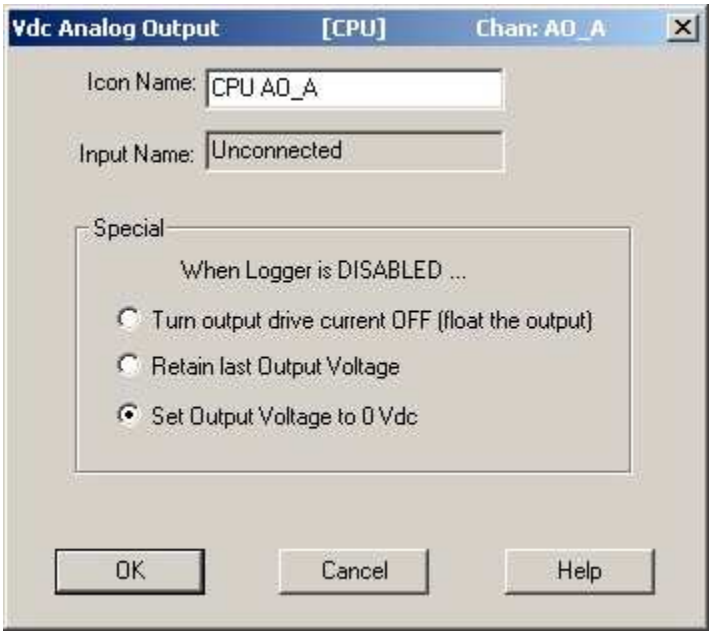
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output only. No Output terminal is shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name will be CPU AO_A or CPU AO_B.

Input Name:

This reflects the name (i.e. Unconnected) of the icon connected to the Analog Output icon's input terminal.

Turn output drive current OFF:

Selecting this option will disconnect (float) the Output when the Logger is stopped.

Retain last Output Voltage:

Selecting this option will prevent the Output from changing when the Logger is stopped.

Set Output Voltage to 0 Vdc:

Selecting this option will drive the Output to zero volts (ground) when the Logger is stopped.

COLD JUNCTION COMPENSATION (CJC) ICON

FUNCTION:

The Cold Junction Compensation (CJC) temperature reading is taken from the integral temperature sensor within the CPU. This sensing function is critical in the calculation of thermocouple temperatures.

Cold junction compensation temperature is sensed using a device with a measurement range from –40 to +125C.

CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

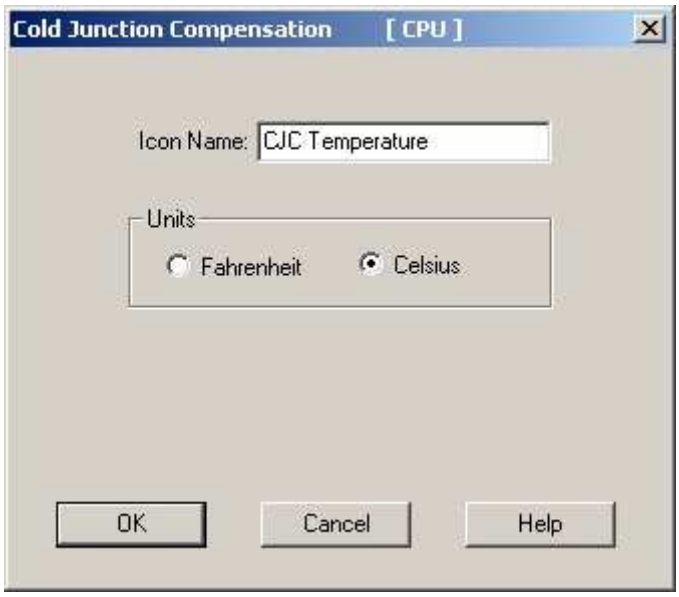
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name will be CPU CJC.

Units:

This specifies the temperature scale units that will be output from this icon. Celsius and Fahrenheit are directly supported, however, conversion to other units may be performed within a Program Net by adding a Math Icon onto this icon's Output.

DIGITAL OUTPUT ICON

FUNCTION:

Two channels of Digital Output are provided with the CPU. The Digital Output icons provide software access to these digital outputs.

CONNECTION TERMINALS:

Input: Logic Data.

Enable: Logic Control

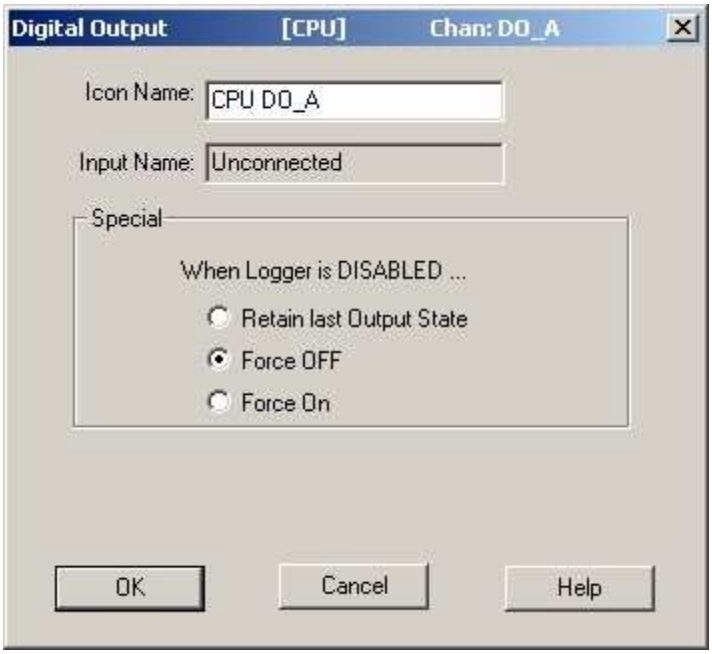
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output only. No Output terminal is shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name is CPU DO_A or CPU DO_B.

Input Name:

This reflects the name (i.e. Unconnected) of the icon connected to the Digital Output icon's input terminal.

Retain last Output State:

Selecting this option will prevent the output from changing state when the Logger is stopped.

Force OFF:

Selecting this option will force the output signal to go LOW when the Logger is stopped.

Force On:

Selecting this option will force the output signal to go HIGH when the Logger is stopped.

GLOBAL SYSTEM SETTINGS (PROGRAM) ICON

FUNCTION:

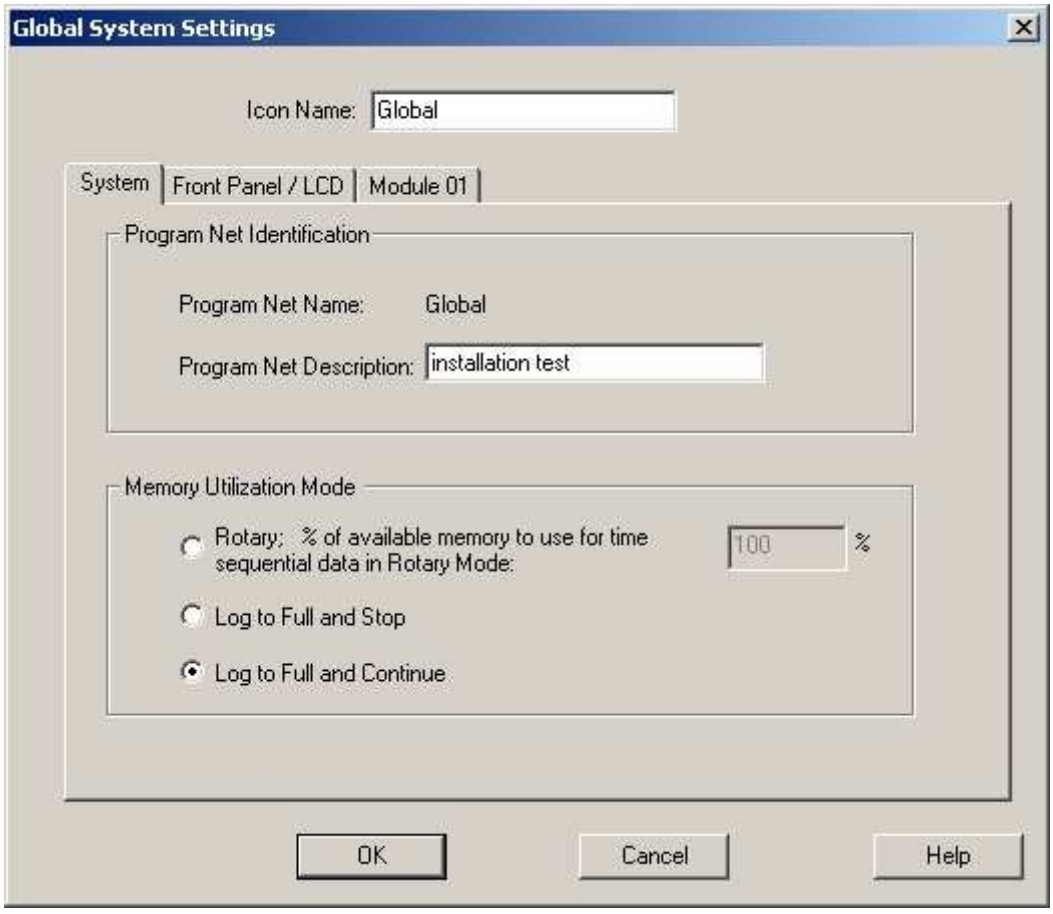
The Global icon provides for definition of various Logger system settings that may be used during the execution of a Program Net. No Input or Output terminals are available on this type of icon.

CONNECTION TERMINALS:

Note: There are NO Terminals shown for icon connections in the Program Net for this icon.

CONFIGURATION DIALOG:

Three types of tabs are used in the configuration of a Global icon: System, Front Panel/LCD, and Module.



CONFIGURATION OPTIONS – SYSTEM TAB:

Basic System Settings are handled on this page.

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. This is also used as the default Program Net name when it is saved as a *.nt2 file. This is limited to 20 characters in length (to fit on the LCD screen) and may only contain digits, letters, spaces or plus, minus, underscore and tilde characters. This name can be accessed from the Logger front panel LCD as well as when using a Status query when connected to a Logger with HyperWare.

Program Net Description:

This is a brief description of the Program Net. This description is limited to 20 characters in length.

Memory Utilization Mode:

ROTARY:
If this option is selected, the Logger will log data until the memory is filled, then begin overwriting the oldest sample in memory. Processing of the complete Program Net will continue as normal. When this mode is selected, the associated percentage must be set.

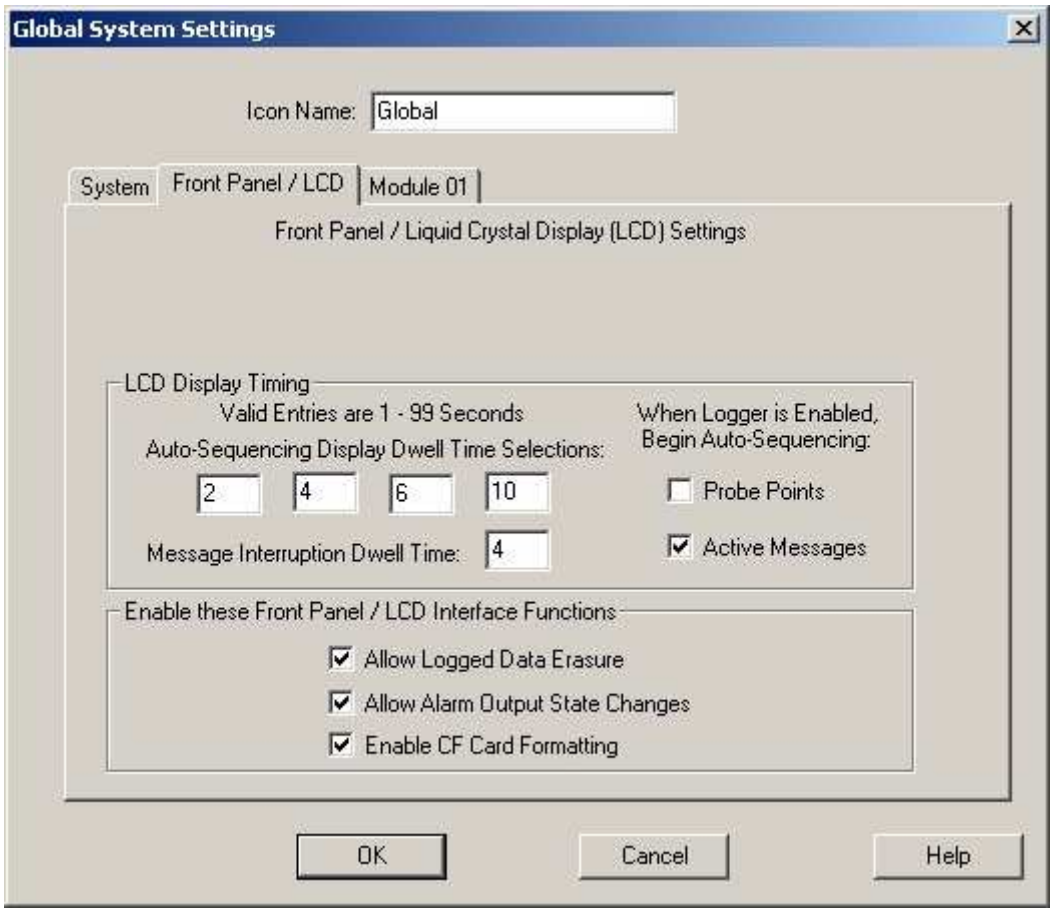
_____%
When *Rotary* mode is selected, this specifies the Percentage of available Logger memory to use for storing sequential data. The rest of the available memory will be used for special icon data files. When the sequential data memory limit is reached, the Logger will delete the oldest sequential data to make room for more data. Generally, the rotary percentage should be set to 100%. One reason to set it to anything less would be to reserve log memory for a subsequent logging session.

LOG TO FULL AND STOP:
If this option is selected, the Logger will log data until memory is filled, then stop execution of the Program Net to conserve battery life.

LOG TO FULL AND CONTINUE:
If this option is selected, the Logger will log data until memory is filled, then continue the execution of the Program Net, without storing any data to memory. This mode allows all of the non-Memory icons in the Program Net to continue operation, providing continued Alarm, Probe Point, etc access. If memory space later becomes available, due to a user erasing some data, then data logging will resume from that point.

CONFIGURATION DIALOG – FRONT PANEL/LCD TAB:

Liquid Crystal Display settings are handled on this page.



Auto-sequencing Display Dwell Time Selections:

When the Logger is configured in Auto-Sequence mode, the LCD will automatically step through all of the Probe Point displays or System Messages in the queue. Dwell Time is the number of seconds that each page is automatically displayed. These selections are the choices a user will be given, to select the rate of auto sequencing (dwell time) during Program Net execution.

Message Interruption Dwell Time:

Some LCD screen messages will briefly interrupt the current display. This setting defines the number of seconds (1 to 99) that the interruption should last.

System and LCD icon messages can occur at any time. If the LCD screen is at the top level, or is auto-sequencing through Probe Points, these messages will immediately interrupt and display on the LCD screen for the number of seconds specified in Message Interruption Dwell Time.

When Logger is Enabled, Begin Auto-Sequencing:

PROBE POINTS:
Checking this box enables Auto-Sequencing of the Probe Point list.

Probe Point icons mark and provide access to nodes within a Program Net. They are similar to Memory (RAM) icons, but are used to display values rather than to store them to memory. The Logger keeps a list of all Probe Points in the Program Net. This list includes the name, most recent value, and units for each Probe Point. While the Logger is enabled these values will be continually updated.

ACTIVE MESSAGES:
Checking this box enables Auto-Sequencing of the Active Messages list.

This list consists of two types of Messages: User-defined ones, generated by the LCD Message icon, and those generated by the System (refer to the Warning icon). Some of the messages in the list will be self-clearing, and the other messages will need to be cleared manually by a user.

If neither of these is checked, the LCD default display will be the top-level screen.

Enable these Front Panel / LCD Interface Functions:

There are a several sub-menus under the LCD Top Level screen. Some of them can be effectively locked out by not checking these enable boxes.

ALLOW LOGGED DATA ERASURE:
Enable erase of memory data.

If this is left *Unchecked*, data can only be erased remotely, using HyperWare II, GreenWater or the Standard Web Pages.

ALLOW ALARM OUTPUT STATE CHANGES:
The functional goals of the Change Alarm States menu are to override / acknowledge an alarm from the unit front panel, or to control the outputs for manual testing. Alarm outputs are hardware outputs that are actually connected within the Program Net. On the CPU, this would include the two relays, the GP+5V, and the two LED's.

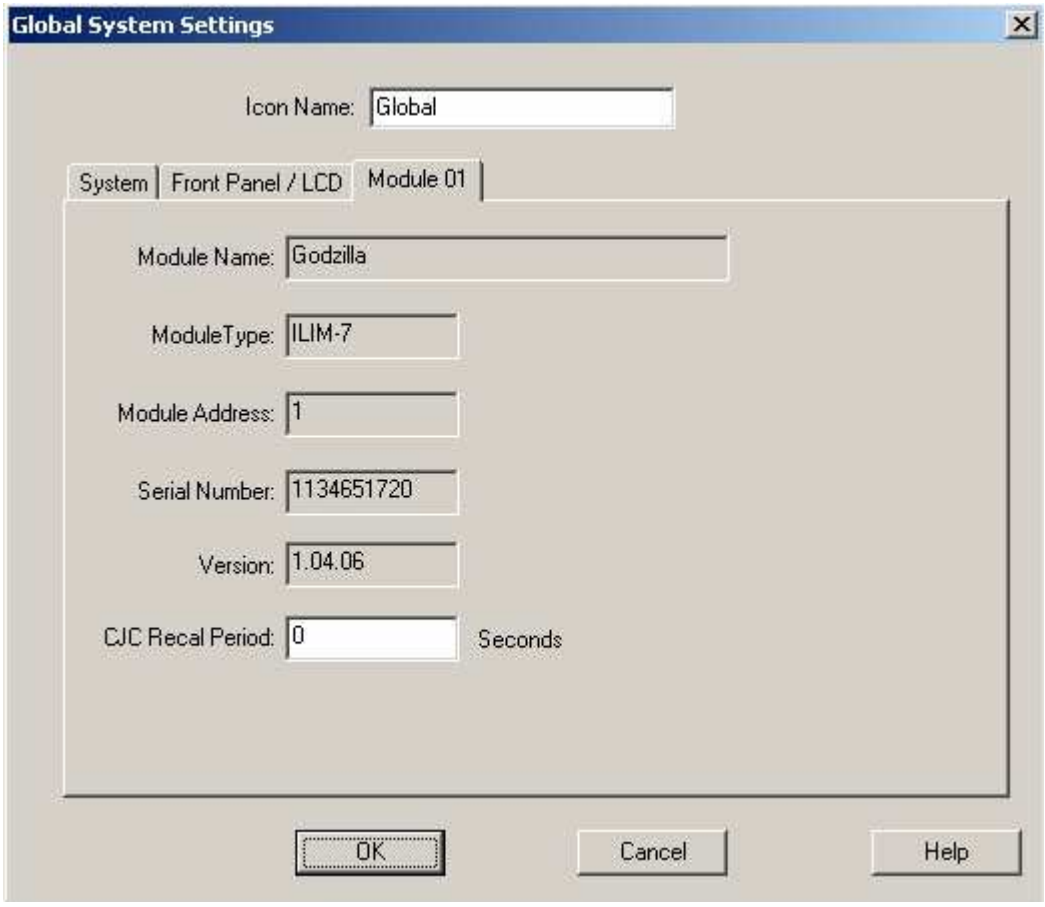
If this is left *Unchecked*, Alarm States can only be changed remotely, using HyperWare II.

ENABLE CF CARD FORMATTING:
When this is checked, if an unformatted CF card is detected while the Logger is stopped, the Logger can attempt to format it.

If this is left *Unchecked*, CF cards can only be formatted remotely, using HyperWare II.

CONFIGURATION DIALOG – MODULE XX (ILIM-7) TAB:

For each module on the BBUS, there will be one configuration page. This page is for an ILIM-7 module. The module number on the tab reflects its BBUS address.



This page is primarily just a status display. It has the most of the same fields as the board dialog on the Communication Window, except that here it is possible to set the CJC update frequency setting, instead of the name.

Module Name:

This is a name unique to that board and is assigned by the user from the Communications Window, not from the Module Tab of the Program icon.

Module Type:

This is the type of module, such as the ILIM-7 (with 8 channels of isolated Input).

Module Address:

This is the address of this board on the BBUS, which is set via DIP switch.

Serial Number:

This is a factory set unique number for each board.

Version:

This is the revision of firmware loaded in the board.

CJC Recal Period:

The Logger performs various self-calibrations during execution of a Program Net. The frequency of these calibrations can be modified. If a 0 is entered for the period, a recalibration will be performed at the start of each Program Net execution. If speed is not of concern, entering 0 for each of the recalibration periods will result in optimum performance.

A Cold Junction Compensation (CJC) sensor is mounted on the board. The temperature it measures on the edge connector is used during thermocouple millivolt to temperature conversions. This CJC Recalibration period specifies how frequently the CJC temperature is checked and updated in the thermocouple calculation equation. Any temperature error in the measurement of the board will result in a nearly equal error in the thermocouple reading.

Note: If a short duration test is being performed where maximum speed of thermocouple readings is required, sufficient accuracy may be achieved by setting the Recalibration Period fairly long. In this way, a CJC recalibration will be done before the first pass through the Program Net, then the high speed readings will be taken, then another CJC recalbration. During the test, the board's thermal mass will keep the CJC temperature fairly constant.

GPDI EVENT MODE ICON

FUNCTION:

The GPDI (General Purpose Digital Input) is a hardware digital Input. This may be used as an event, counter, or frequency Input, depending on which mode is selected. The CPU has four GPDI channels. When configured as an Event input, the GPDI icon samples the input Signal State (High or Low) per the sampling rate set on the Trigger input. It updates its Output only when the Input changes state.

CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

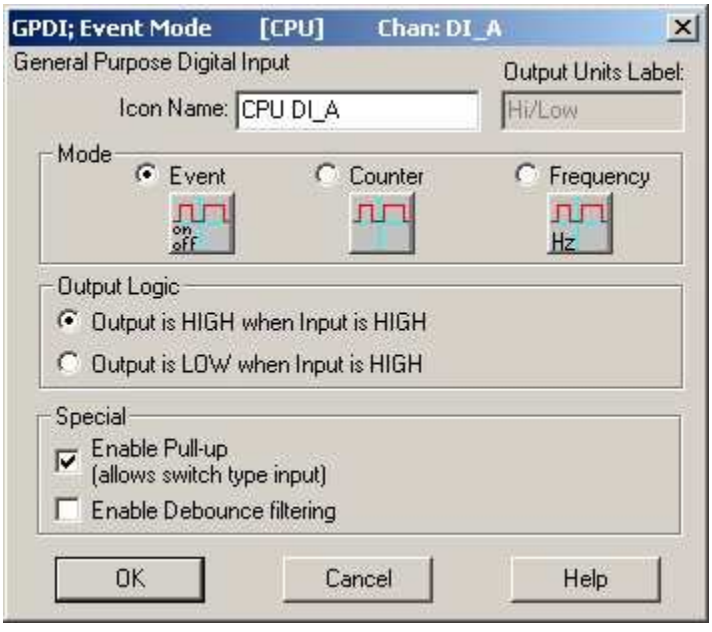
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Logic Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to D) where the actual Interface Module channel is installed will be appended to the default name CPU DI_.

Output Units Label:

In Event mode the units cannot be changed. The “Hi/Low” Units label and the green Logic Output identify the GPDI in the Program Net as being in Event mode.

Output Logic:

This indicates whether to pass the hardware signal into the Program Net exactly as is (Output is HIGH when Input is HIGH) or inverted (Output is LOW when Input is HIGH). For example, if a switch is connected to the Event icon input, the user can then specify which state the switch should be in for a HIGH output from the Event icon.

Enable Pull-up:

Check this box for a simple physical switch connected to the Input, to prevent it from floating when the switch is open.

If the Input is connected to a sensor that will drive it High or Low, leave this box *Unchecked* so the Pull-up does not interfere with the sensor signal.

Enable Debounce Filtering:

Enables a hardware filter circuit that prevents short duration transitions from passing into the icon. Debounce can be used to filter out contact bounce from mechanical switches. The GPDI debounce has a time constant of approximately 50mS. Note that the use of debounce will delay the actual input to output time by 50 to 200 mS.

> **Note:** Contact bounce is a phenomenon that occurs when a mechanical switch opens or closes. During switching, the physical electrical contacts inside the switch bounce against each other a number of times before they settle to their final state. Depending on the duty cycle of the contact bounce, the Logger could count these bounces as events or transitions (count mode), resulting in technically accurate but undesired data. By enabling the debounce function, typical short duration contact bounce will be filtered out.

GPDI COUNTER MODE ICON

FUNCTION:

The GPDI (General Purpose Digital Input) is a hardware digital Input. This may be used as an event, counter, or frequency Input, depending on which mode is selected. The CPU has four GPDI channels. When configured as a Counter Input, the GPDI icon accumulates counts from a hardware signal Input, then outputs the count when it receives a Trigger pulse. The GPDI Counter (in contrast to the Count Accumulator) is very fast and can count pulses received at Input rates up to approximately 20 kHz. When using the GPDI Counter with high speed inputs, it is imperative that the counter be cleared before it overflows, or a counter roll-over condition will occur (start over at zero), causing data to be lost.

CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

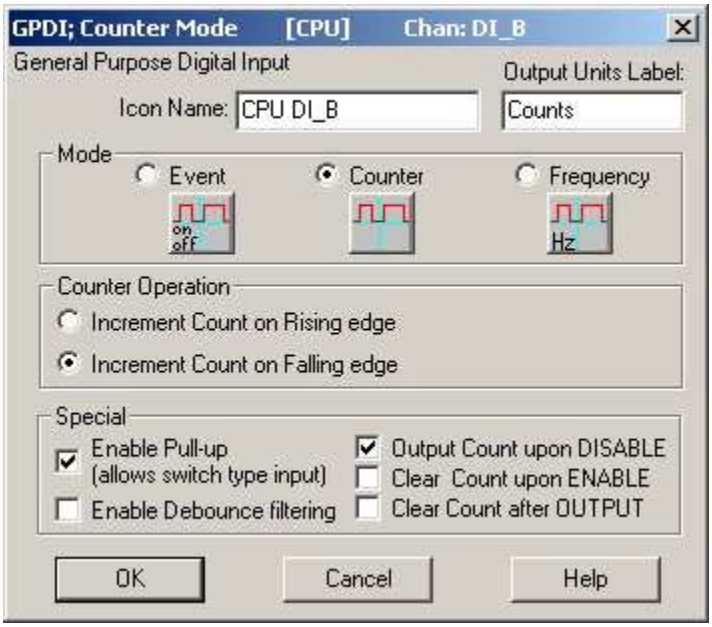
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to D) where the actual Interface Module channel is installed will be appended to the default name CPU DI_

Output Units Label:

This provides a text box for entry of a units label that will be shown at the output from this icon.

Counter Operation:

The GPDI increments its accumulated count only when its Input changes state. The user can specify which transition (edge) is to be counted: Rising (low to high) or Falling (high to low). For example if a switch is connected to the Input, the User can specify that the count increment when the switch closes (Falling Edge) or when it opens (Rising Edge).

Enable Pull-up:

Check this box for a simple physical switch connected to the Input, to prevent it from floating when the switch is open.

If the Input is connected to a sensor that will drive it High or Low, leave this box *Unchecked* so the Pull-up does not interfere with the sensor signal.

Enable Debounce Filtering:

Enables a hardware filter circuit that prevents short duration transitions from passing into the icon. Debounce can be used to filter out contact bounce from mechanical switches. The GPDI debounce has a time constant of approximately 50mS. Note that the use of debounce will delay the actual input to output time by 50 to 200 mS.

> **Note:** Contact bounce is a phenomenon that occurs when a mechanical switch opens or closes. During switching, the physical electrical contacts inside the switch bounce against each other a number of times before they settle to their final state. Depending on the duty cycle of the contact bounce, the Logger could count these bounces as events or transitions (count mode), resulting in technically accurate but undesired data. By enabling the debounce function, typical short duration contact bounce will be filtered out.

Output Count upon DISABLE:

If this box is checked, each time the icon is disabled, the output will be forced just as if a Trigger Pulse had been received.

Clear Count upon ENABLE:

If this box is checked, each time the icon is enabled, the counter will be automatically reset back to 0 and counting resumes. However this will *NOT* force an extra Output.

Clear Count after OUTPUT:

If this box is checked, every time the count is output, the counter is automatically reset back to 0 and counting resumes.

If this box is left *Unchecked*, the counter will resume counting after output, but starting from the value which was output.

GPDI FREQUENCY MODE ICON

FUNCTION:

The GPDI (General Purpose Digital Input) is a hardware digital Input. This may be used as an event, counter, or frequency Input, depending on which mode is selected. The CPU has four GPDI channels. When configured as a Frequency Input, the GPDI icon samples the incoming waveform and outputs the measured frequency to the net.

Calculation of the Input signal frequency requires a net scan time of at least about double the period of the lowest expected frequency. Hz is "cycles per second," so 10 Hz would have a period of 100ms, needing a net scan trigger of 200 ms or slower.

> **NOTE:** Due to the advanced signal processing utilized in the frequency mode, unbalanced duty-cycle Inputs are measured with the same accuracy as balanced duty-cycle Inputs.

CONNECTION TERMINALS:

> **Note**: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

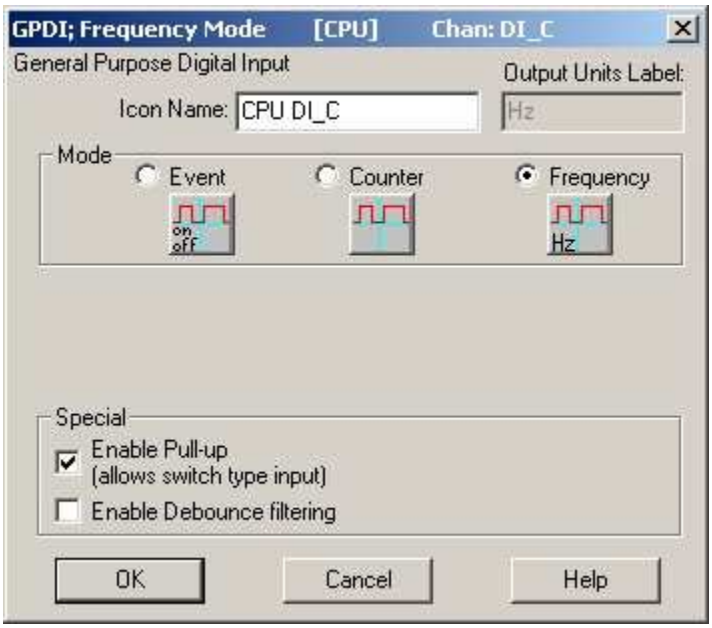
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Digital Input Channel (A to D) where the actual Interface Module channel is installed will be appended to the default name CPU DI_.

Enable Pull-up:

Check this box for a simple physical switch connected to the Input, to prevent it from floating when the switch is open.

If the Input is connected to a sensor that will drive it High or Low, leave this box *Unchecked* so the pull-up does not interfere with the sensor signal.

Enable Debounce Filtering:

Enables a hardware filter circuit that prevents short duration transitions from passing into the icon. Debounce can be used to filter out contact bounce from mechanical switches. The GPDI debounce has a time constant of approximately 50mS. Note that the use of debounce will delay the actual input to output time by 50 to 200 mS.

> **Note:** Contact bounce is a phenomenon that occurs when a mechanical switch opens or closes. During switching, the physical electrical contacts inside the switch bounce against each other a number of times before they settle to their final state. Depending on the duty cycle of the contact bounce, the Logger could count these bounces as events or transitions (count mode), resulting in technically accurate but undesired data. By enabling the debounce function, typical short duration contact bounce will be filtered out.

LED OUTPUT ICON

FUNCTION:

Two green LEDs (Light Emitting Diode) are provided as an integral part of the CPU and display on the front panel of the Logger. The green LED icons provide software access to these outputs.

CONNECTION TERMINALS:

Input: Logic Data.

Enable: Logic Control

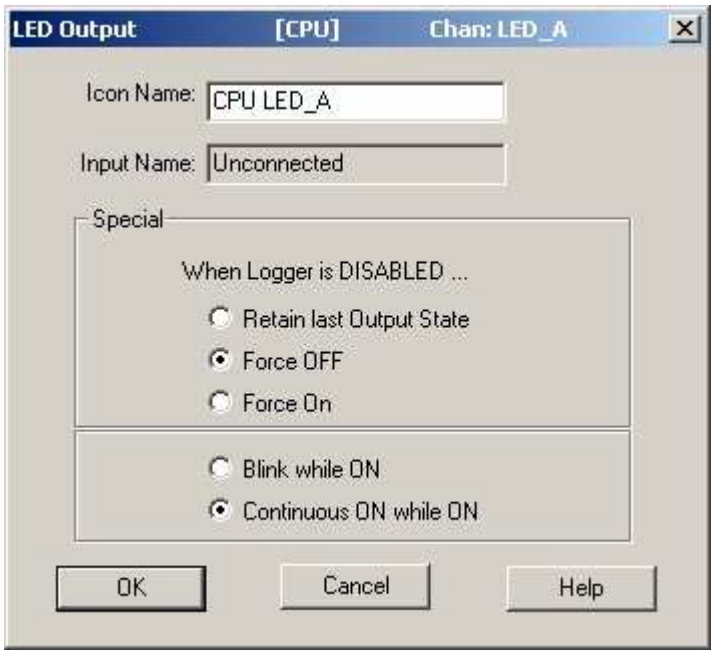
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output only. No Output terminal are shown on icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name is CPU LED_A or CPU LED_B.

Input Name:

This reflects the name (i.e. Unconnected) of the icon connected to the green LED icon's Input Terminal.

Retain last Output State:

Selecting this option will prevent the output from changing state when the Logger is stopped.

Force OFF:

Selecting this option will force the output signal to go LOW when the Logger is stopped.

Force On:

Selecting this option will force the output signal to go HIGH when the Logger is stopped.

Blink while On:

Selecting this option will force the output signal to pulse at one-second intervals while the Input is HIGH.

Continuous On while On:

Selecting this option will force the output signal to remain HIGH while the Input is HIGH.

mA Input Icon

Function:

The Analog Inputs of the CPU can be configured via DIP switches as either milliAmp Inputs or as Low Voltage/Thermocouple Inputs. Analog Input (AI) channels A and B (rightmost) here have dip switches configured for Thermocouple/Low Voltage (up), while Channel C (leftmost) is configured for current (down).

The CPU has three channels that can be configured this way. The last of these Channels (AI_C) has a fixed gain, so when it is configured as a Voltage icon it is limited to the range –11 to +32 mA. The mA Input icon performs the analog channel selection, amplification, and A-D conversion for a DC current Input within the range of +/-20mADC.

Connection Terminals:

> **Note**: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

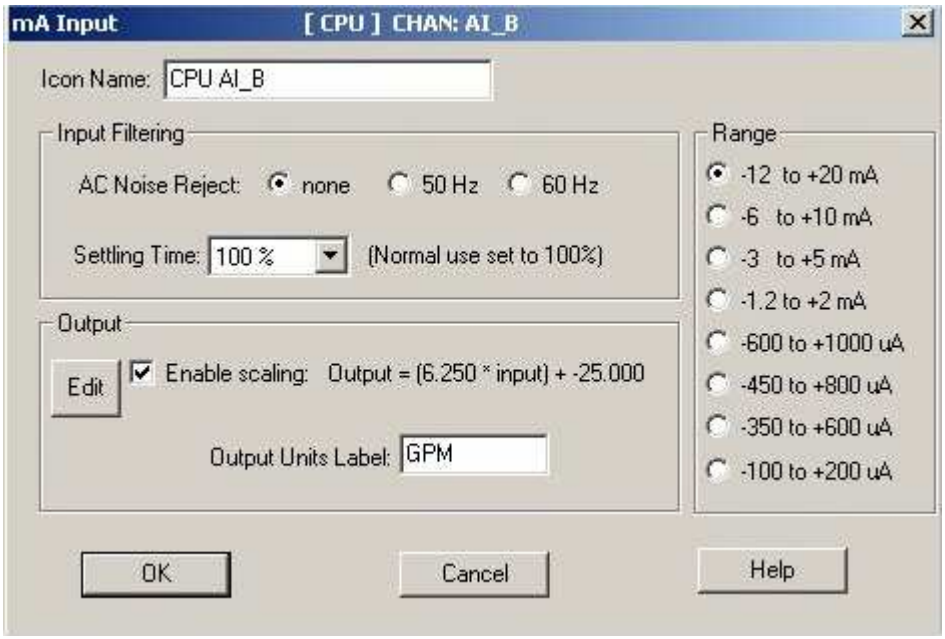
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to C) where the actual Interface Module channel is installed will be appended to the default name CPU AI_.

AC Noise Reject:

Enables software filtering of 50Hz or 60Hz noise on Inputs.

> See Appendix for an explanation of the 50/60 Hz filtering technique.

Settling Time:

This provides additional time for sensors that need to settle. This setting might be changed if a user has a very high output impedance sensor or input divider to which the channel is being connected. The fastest setting is the default: 100%. A drop-down list allows the User to select increased settling times, up to 400%, with the cost that it slows down the rate at which a channel can be sampled.

Range:

This specifies the current range to be used for the channel. Select the range so that anticipated Input signal fluctuations will not exceed this full-scale range. If the Input exceeds the selected range, an over-range value will be logged.

> **Note:** Channel AI_C has a fixed gain, so it is limited to the range –11 to +32 mAdc

Output Units Label:

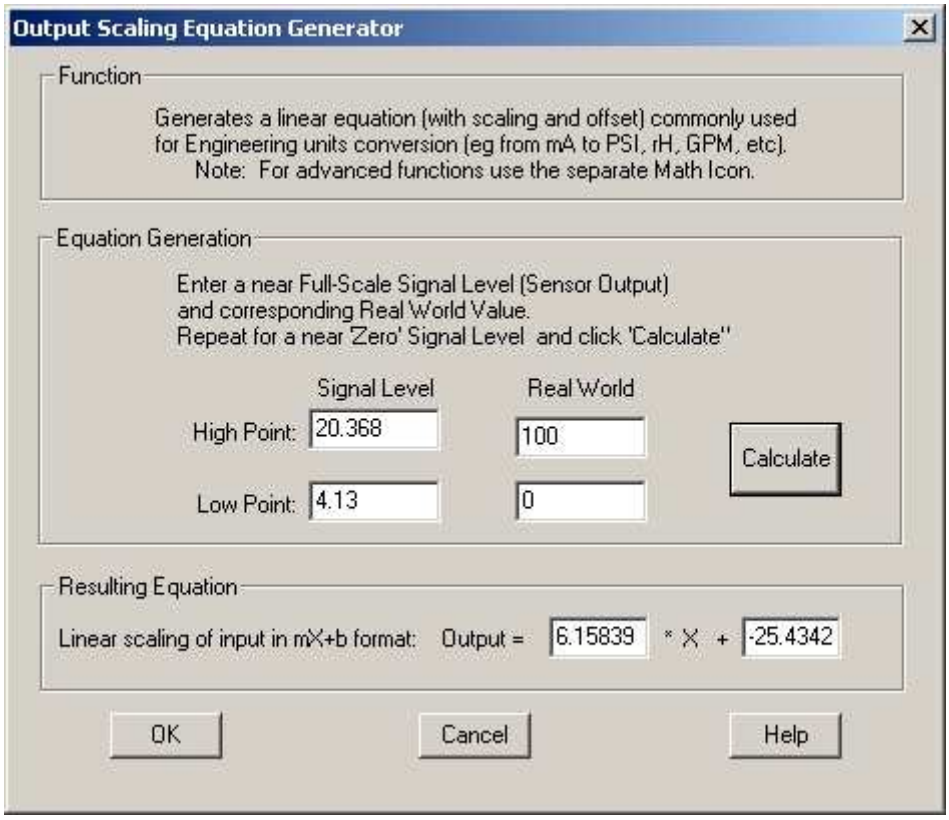
This specifies the units that will be output from this icon. This will be kept at mA unless scaling is used to perform a conversion.

Enable scaling:

When this checked, it enables the ***Edit*** button for automatic linear Equation Generation.

Edit:

In the example below, a 4-20 mA Output pressure transducer is attached to the logger. The pressure transducer Input range is 0-100 PSI.


Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate''
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

$$\text{Output} = mX + b$$

To create a function, enter the calibrated range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that this represents (here 0 to 100 PSI). Then select *Calculate* to generate the values for m and b (6.15839 and –25.4342, respectively). Finally, selecting *OK* returns to the main configuration dialog and puts the equation into the Function automatically.

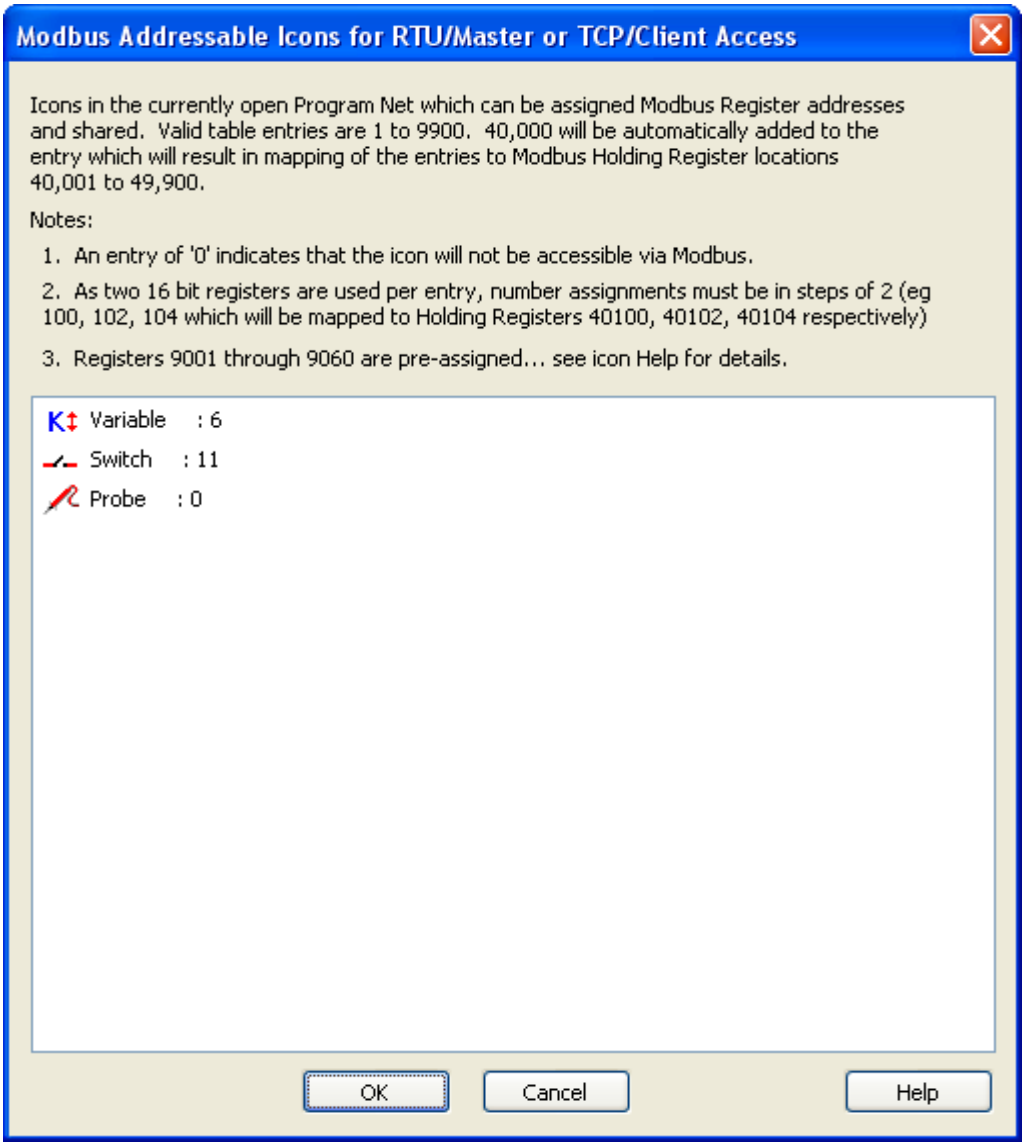
MODBUS REGISTER LIST ICON

FUNCTION:

The Modbus Register List icon is available when the Modbus TCP Server and/or the Modbus RTU Slave options are available on the IntelliLogger (if you are attempting to use the IntelliLogger in Master/Client mode refer to **Modbus Slave / Server Device Icon**). This icon appears on the workspace (not the icon palette) within the Programming Window when the connected IntelliLogger is queried for Hardware configuration and the option is available.

The Modbus Register List icon is used to associate Modbus accessible icons within the Program Net with Modbus register addresses which can then be accessed by Modbus RTU Master or Modbus TCP Client devices that are connected to the IntelliLogger.

CONFIGURATION DIALOG:


Modbus Addressable Icons for RTU/Master or TCP/Client Access
Icons in the currently open Program Net which can be assigned Modbus Register addresses and shared. Valid table entries are 1 to 9900. 40,000 will be automatically added to the entry which will result in mapping of the entries to Modbus Holding Register locations 40,001 to 49,900.
Notes:
1. An entry of '0' indicates that the icon will not be accessible via Modbus.
2. As two 16 bit registers are used per entry, number assignments must be in steps of 2 (eg 100, 102, 104 which will be mapped to Holding Registers 40100, 40102, 40104 respectively)
3. Registers 9001 through 9060 are pre-assigned... see icon Help for details.
Variable : 6
Switch : 11
Probe : 0
OK
Cancel
Help

CONFIGURATION OPTIONS:

Icon Addresses:

When this icon is opened, the current Program Net is scanned and all icons that can be assigned a Modbus address are included in the displayed Register List. Icons that can be accessed include Probe Point, Remote Constant and Remote Control icons.

To assign Register addresses, simply click on the number next to each icon name and assign it a value from 0 to 9900. If an icon has been assigned an address of 0, it will be precluded from access by other Modbus devices.

All Logger Probe Points, Remote Control Switches, and Remote Constants are 32 bits in length, thus utilize two sequential Modbus addresses. For example, if a Probe Point icon is assigned to address 1, Modbus addresses 1 and 2 are used to return the Probe Point value. Addresses assigned in the dialog must be at least a value of two apart. For example, assigning two probe points at Modbus addresses 1 and 3 is valid. Assigning them at addresses 1 and 2 is not valid.

When Logger points are read or written from a Modbus Master/Client device, an even number of Modbus addresses must be requested.

Multiple Logger data points may be read in a single Modbus message. For example, if two probe points are assigned to addresses 1 and 3, a Modbus message may request the values at 4 addresses beginning at address 1.

Unassigned addresses may not be accessed. For example, if two Probe Points are assigned to addresses 1 and 5, it is invalid to request the values of 6 addresses beginning at address 1 (assuming no other assignment has been made for address 3).

Note: When accessing the Registers from a connected Modbus Master/Client device you must add 40,000 to the address so that they represent addresses 40,001 to 49,900

Register Interpretation:

Remote Controls 32-bit (2 registers) integers. A 0 represents FALSE and any number other than zero represents TRUE.

Remote Constants are 32-bit (2 registers) floating point numbers.

Probe Point Boolean values are 32-bit (2 registers) integers. A 0 represents FALSE and a 1 represents TRUE.

Probe Point analog values are 32-bit (2 registers) floating point numbers, regardless of which output data type (float/integer) has been selected in the individual Probe Point Icon's configuration dialog.

Dedicated Use Status Addresses:

A set of IntelliLogger Status parameters has been permanently assigned to a range of addresses. These addresses are in addition to (and not listed within) the Modbus Register Listing. As above, these Registers can be accessed from a connected Modbus Master/Client device.

The Dedicated Status Registers follow:

Starting Address	Field
9001	Logger Name (Character String)
9012	Unit Name (Character String)
9023	Software Version (4 byte value)
9025	System Status Flags (32 single-bit flags)
9027	Logger Time (32-bit integer seconds)
9029	Logging Start Time (32-bit integer seconds)
9031	Program Net Name (Character String)
9042	Program Net Description (Character String)
9053	Log Memory Size (32-bit integer)
9055	Log Memory Used (32-bit integer)
9057	Net Memory Size (32-bit integer)
9059	Supply Voltage (floating-point volts)

System Status Flags:

The System Flags starting at address 9025 are each a single bit that can be either a 1 meaning true or a 0 meaning false. To read these flags you must still read all 32 bits from the IntelliLogger and filter or pick out the flag whose value you wish to know. Note that not every bit has an associated system status flag. The most significant bit would be numbered 31 and least significant bit would be numbered 0 in the table below:

Bit	Definition
31	The IntelliLogger is logging
30	Log memory is full
29	Log memory is wrapping
28	Log memory is in rotary mode
27	Log memory is in Compact Flash memory
26	No net ready to enable
25	Error in last attempted net load
24	System configuration error
15	Memory usage is past the threshold
14	Scan overrun
13	Backup battery voltage is low
12	Power failure
11	Manual reset
10	Net runtime error
9	BBus error

Considerations in Use:

The logger uses the Modbus convention of addressing the first available register as register one. Some debugging tools or applications are known to address the first available address as zero. As a result, if the logger is used with one of these tools, the tool will incorrectly access members of the status block and/or probe point values.

Typically, this situation may be resolved by using an address one less than the address expected. For example, try using address 9058 instead of address 9059 to read the logger supply voltage in such cases.

Note: Some that third-party tools may reverse the order of the two adjacent 16-bit registers used to form a 32-bit element used by the logger. This situation may be resolved by checking the "Swap Data" check-box on the Logger Configuration - Modbus Tab

Error Codes

The following Modbus error codes can be returned when the IntelliLogger is operating as a Modbus Slave device:

ERROR CODE 1:
The IntelliLogger received a Modbus function code other than the two accepted codes, 0x03 (read multiple registers) or 0x04 (write multiple registers).

ERROR CODE 2:
The IntelliLogger received a Modbus read or write request but the net's Modbus icon does not contain any configured Modbus addresses.

ERROR CODE 3:
- The IntelliLogger received a Modbus write request that contains fewer bytes of data than are called for by the request.
- The IntelliLogger received a Modbus read request that is asking for more bytes than the maximum allowed size of a Modbus message.
- The IntelliLogger received a Modbus read or write request that was badly malformed and does not contain enough bytes for the register address or register count.
- The IntelliLogger received a Modbus read or write request for a net data point (all are contained in 2 registers each) in an odd number of registers. Since all net data points are each contained within 2 registers, the number of registers in a Modbus read or write requests for net data points must always be a multiple of 2.
- The IntelliLogger received a Modbus read or write request for the second of two consecutive registers comprising a 32-bit, 2 register data point. For example, requesting register 2 if a data point comprises registers 1 and 2.
- The IntelliLogger received a Modbus write request for a Probe Point.

ERROR CODE 4:
The IntelliLogger received a Modbus read or write request for a register or status block that has not been configured for use in the net's Modbus icon.

RELAY ALARM IC8ON

FUNCTION:

Two Relay Alarm Outputs are provided as an integral part of the CPU. The Relay Alarm icons provide software access to these alarm outputs.

CONNECTION TERMINALS:

Input: Logic Data.

Enable: Logic Control

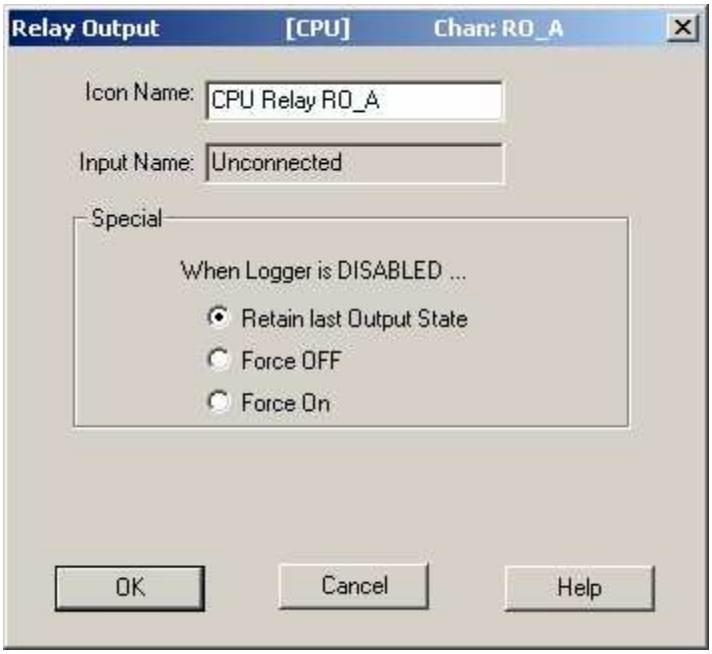
Processing of icon is allowed:

when Enable terminal is unconnected

OR when connected *and* Enable signal is HIGH.

Note: Hardware Output only. No Output terminals are shown on the icon for Program Net connections.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the default name is CPU RO_A or CPU RO_B.

Input Name:

This reflects the name (i.e. Unconnected) of the icon connected to the Relay Alarm icon's input terminal.

Retain last Output State:

Selecting this option will prevent the output from changing state when the Logger is stopped.

Force OFF:

Selecting this option will force the output signal to go LOW when the Logger is stopped.

Force On:

Selecting this option will force the output signal to go HIGH when the Logger is stopped.

SUPPLY VOLTAGE (BATTERY) ICON

FUNCTION:

This is used to take readings of the Logger Supply Voltage. If internal batteries are installed in the Logger and an external power supply is also connected, the output value will be the higher of the two.

CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

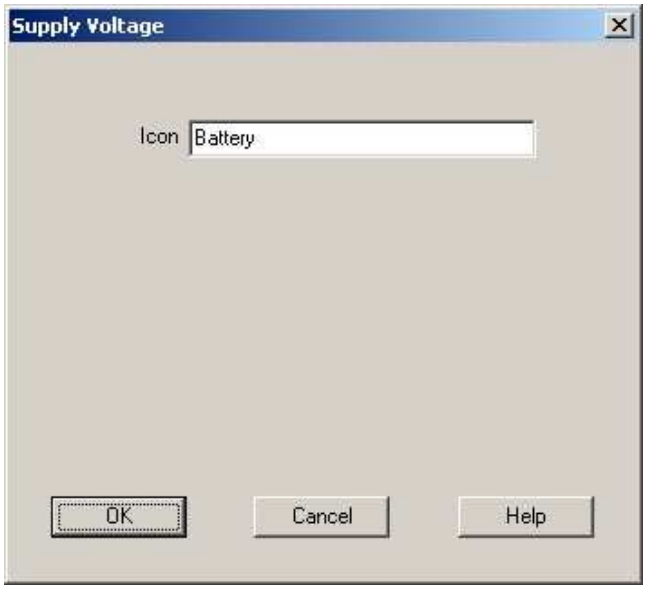
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window.

THERMOCOUPLE (TC) ICON

FUNCTION:

The Analog Inputs of the CPU can be configured via DIP switches as either milliAmp Inputs or as Low Voltage/Thermocouple Inputs. Analog Input (AI) channels A and B (rightmost) here have DIP switches configured for Thermocouple/Low Voltage (up), while Channel C (leftmost) is configured for current (down).

Only the first two of these Channels (AI_A and AI_B) can be configured as Thermocouples. The Thermocouple icon performs the thermocouple channel selection, amplification, CJC and A-D conversion for thermocouple hardware Input. The CJC reading is taken from the thermal sensor on the CPU, described above.

CONNECTION TERMINALS:

Note: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

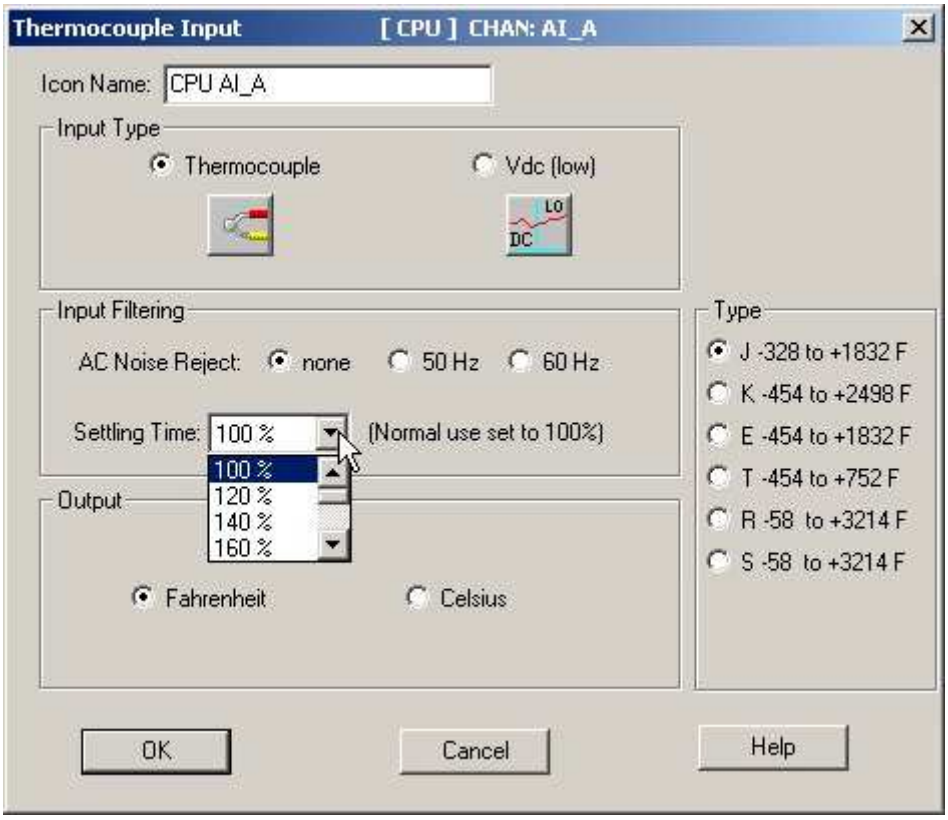
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to C) where the actual Interface Module channel is installed will be appended to the default name CPU AI_.

Input Type:

Both the Thermocouple (TC) icon and the Low Voltage (Vdc-Low) icon utilize the same Interface Module hardware Configuration Switch setting. Because of this capability, a Thermocouple icon can be changed into a Vdc-Low icon by simply clicking on the button in the Configuration Dialog.

AC Noise Reject:

Selecting this enables software filtering of 50Hz or 60Hz noise on Inputs.

See Appendix for an explanation of the 50/60 Hz filtering technique.

Settling Time:

This provides extra time for sensors that need to settle. This setting might be changed if a user has a very high output impedance sensor or input divider to which the channel is being connected. The fastest setting is the default: 100%. A

drop-down list allows selection of increased settling times, up to 400%, with the cost that it slows down the rate at which a channel can be sampled.

Type:

This specifies the type and range of Thermocouple that is attached to this icon's input channel on the CPU edge connector. The temperature range is displayed next to the ANSI code for the sensor, according to the units selected in Output (see below).

Output:

This specifies the temperature scale units that will be output from this icon. Celsius and Fahrenheit are directly supported. The range for different types will change automatically as the output units change. Conversion to other units can be performed within a Program Net by adding a Math icon onto this icon's Output.

VDC-LOW INPUT ICON

FUNCTION:

The Analog Inputs of the CPU can be configured via DIP switches as either milliAmp Inputs or as Low Voltage/Thermocouple Inputs. Analog Input (AI) channels A and B (rightmost) here have DIP switches configured for Thermocouple/Low Voltage (up), while Channel C (leftmost) is configured for current (down).

The CPU has three channels that can be configured this way. The last of these Channels (AI_C) has a fixed gain, so when it is configured as a Voltage icon it is limited to the range –1.1 to +3.2 Vdc. The Low Voltage icon performs the analog channel selection, amplification, and A-D conversion for a DC voltage Input within the range of +/-2V.

CONNECTION TERMINALS:

> **Note**: Internal Input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

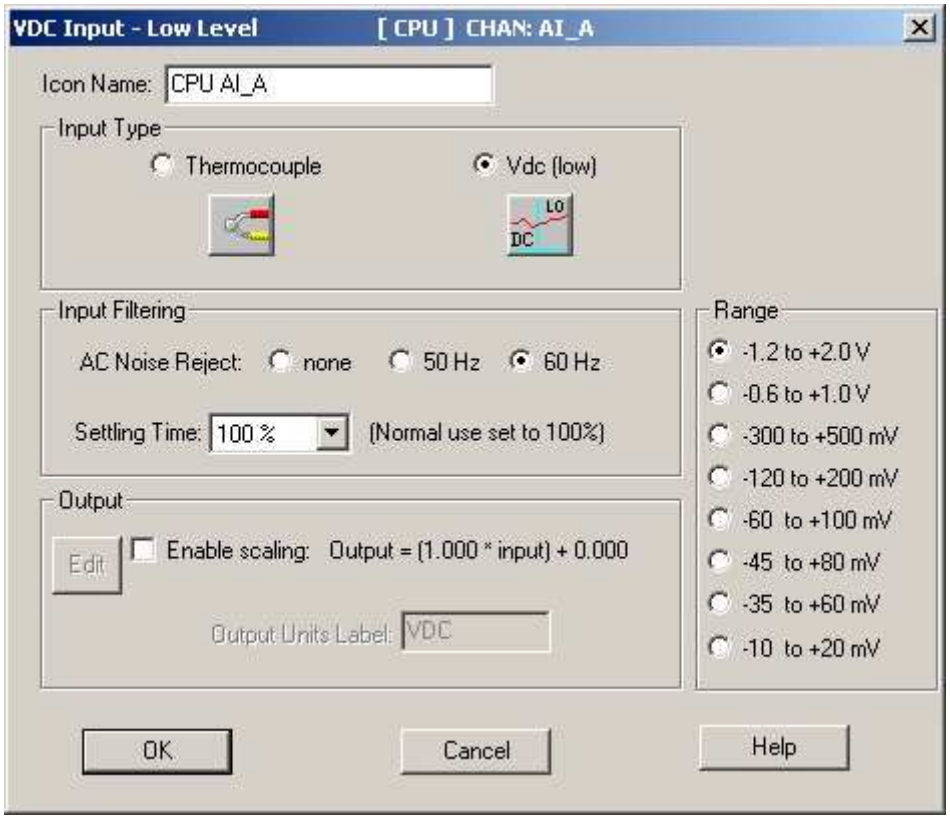
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to C) where the actual Interface Module channel is installed will be appended to the default name CPU AI_

Input Type:

Both the Thermocouple (TC) icon and the Low Voltage (Vdc-Low) icon utilize the same Interface Module hardware Configuration Switch setting. Because of this capability, a Thermocouple icon can be changed into a Vdc-Low icon by simply clicking on the button in the Configuration Dialog.

AC Noise Reject:

Selecting this enables software filtering of 50Hz or 60Hz noise on Inputs.

See Appendix for an explanation of the 50/60 Hz filtering technique.

Settling Time:

This provides extra time for sensors that need to settle. This setting might be changed if a user has a very high output impedance sensor or input divider to which the channel is being connected. The fastest setting is the default: 100%. A

drop-down list allows the selection of increased settling times, up to 400%, with the cost that it slows down the rate at which a channel can be sampled.

Range:

This specifies the Voltage range to be used for this channel. Select the range so that anticipated signal fluctuations will not exceed this full-scale range. If the Input exceeds the selected range, an over-range value will be logged.

> **Note:** Channel AI_C has a fixed gain, so it is limited to the range –1.1 to +3.2 Vdc

Output Units Label:

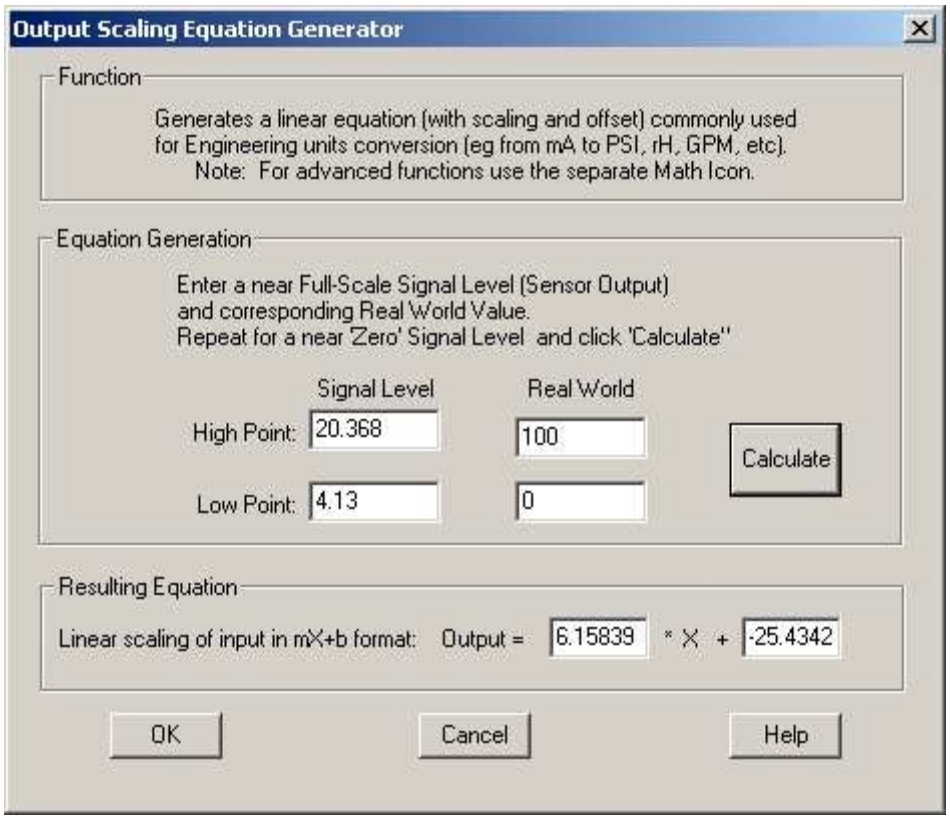
This specifies the units that will be output from this icon. This will be kept at Vdc unless scaling is used to perform a conversion.

Enable scaling:

When this checked, it enables the ***Edit*** button for automatic linear Equation Generation.

Edit:

In the example below, a 4-20 mA Output pressure transducer is attached to the logger. The pressure transducer input range is 0-100 PSI.


Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate''
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

Output = mX + b

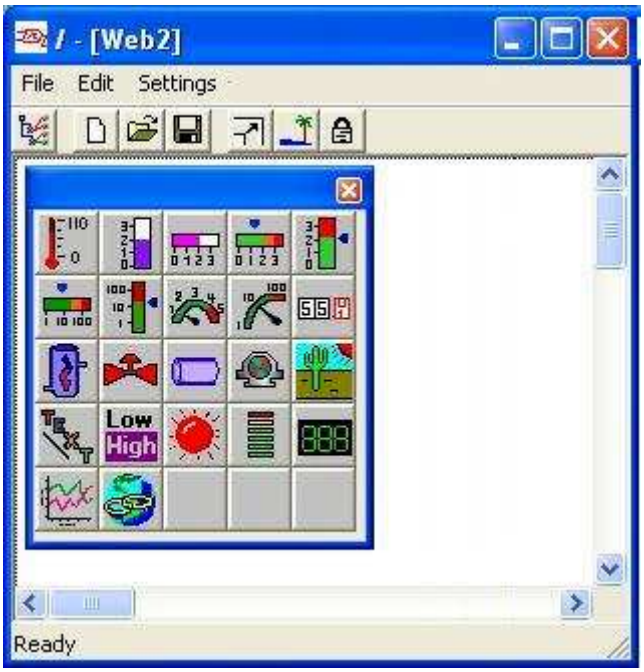
To create a function, enter the calibrated range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that this represents (here 0 to 100 PSI). Then select ***Calculate*** to generate the values for m and b (6.15839 and –25.4342, respectively). Finally, selecting ***OK*** returns to the main configuration dialog and puts the equation into the function automatically.

16 APPENDIX C: CUSTOM WEB PAGE ICON REFERENCE

Custom Web Pages are used to monitor live data using the Real-Time Trending Window of HyperWare, or remotely using the GreenWater™ application. These methods display the data graphically, using a wide variety of graphic objects.

OVERVIEW

All Web Page Objects are available from the Web Design Palette, as shown below.



Most objects on the Palette are used to represent Analog data. Many of these may be used to display Logic Level data also by setting a threshold 0.5. A few of the objects are special:

VALVE

The only Object that applies only to Logic (High/Low) data is the Valve.

MOTOR **AND PIPE**

These two Objects are animated. During long intervals between Value changes, they continue to "move" graphics within the Object.

TEXT LABEL

This Object is perfect for labeling anything on the Web Page.

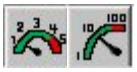
IMAGES

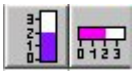
In additional to the background image, small pictures such as a company logo can be added to Web Pages using this type of object.

HYPERLINK
This provides a quick reference to another Web Page.

PLOTTER
Only the plotter displays data for multiple data sources over time.

ICON – NAME CROSS REFERENCE

 Angular Gauges

 Bar Meters

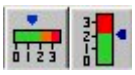
Digital Readout

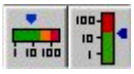
HyperLink

Image

LED

LED Bar

 Linear Gauges

 Logarithmic Gauges

Motor

Odometer

Pipe

Plotter Object

Tank Level

Text Label

Thermometer

Toggling Text

Valve

COMMON PROPERTIES

Web Page objects do not interconnect, but can be selected, moved, deleted, or resized. Each object has its own configuration dialog. Whenever a configuration dialog is closed, the object associated with it will be redrawn with the latest settings, making it easy to experiment with different parameters.

Each object that displays data must be associated with a Probe Point from a Program Net.

> **Note:** Web objects do not use Memory (RAM) icons. There must be a red Probe Point icon connected to a data point to make it available for monitoring live data.

CONFIGURATION DIALOGS

Objects must be configured before they can be used. Configuration entails selection of various operational parameters such as association with a Probe Point, image file pathname, visible range, etc. All of this is simply done through the configuration dialog associated with each object.

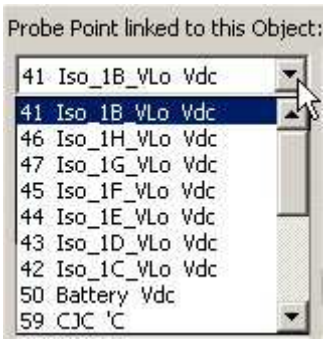
Configuring objects is similar to configuring icons. There are a few special settings, such as selecting colors or fonts, but the most important difference between Icons and objects is the *Probe Point List*.

To configure an object that has been placed on the workspace, double-click on the graphic to open its configuration dialog. Various standard Windows techniques are used to select the different parameters within the dialog, from text entry, to color and font editing, to selection via radio buttons.

Each object has a unique configuration dialog with programmable parameters to meets its needs. However, many parameters are common to the different types of objects. The items below illustrate some common configuration parameters.

PROBE POINT LINK

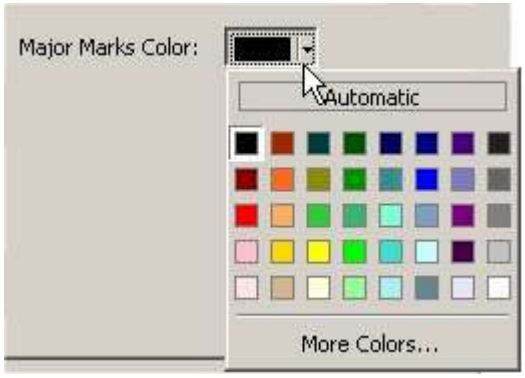
Instead of having an Icon Name, most Web objects are associated with a Probe Point (PP) icon from the Program Net. This is accomplished using a drop-down list of available Probe Points. The unlabelled columns of the list are Probe Point Number, Name and Units.



The associated Probe Point from the Program Net in the Logger will provide the data for this object, either on the Real-Time Trending Window or in a Web Page viewed by GreenWater™.

COLOR DIALOG

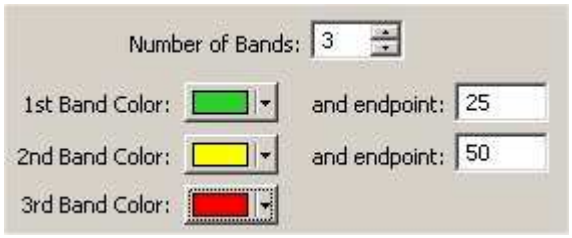
Many objects provide the ability to change one or more colors. These color selections are made using a common pop-up window.



When setting the color of tick marks, the Major marks can be set to a different color than the Minor marks, both independent of the Font Color of the Numbers.

COLOR BANDS

Some objects have color coding for ranges of values. These color bands provide additional feedback about what the value means. For example, an object set to monitor pressure might have three bands: Green for normal, Yellow to indicate pressure should be monitored closely, and Red for danger.

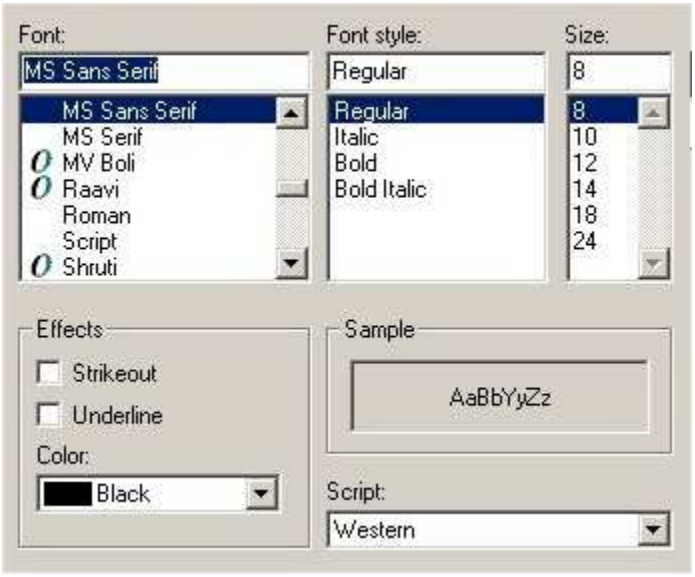


In the example above, the 1st Band is from the Minimum Value of the Scale up to 25. The yellow Band extends from 25 to 50. The 3rd Band is between 50 and the Maximum Value of the Scale.

The endpoints of each color band must be within the Scale. Even if Auto Scale was chosen for Scale Mode, which automatically adjusts the Min and Max of the Scale, it will have to include all enabled Color Band Endpoints.

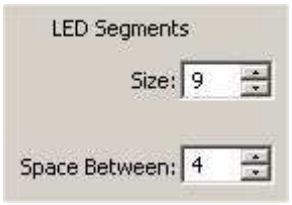
FONT DIALOG

Fonts may be modified for text and numbers, by clicking on a *Font* button, a common window is displayed allowing font selection.



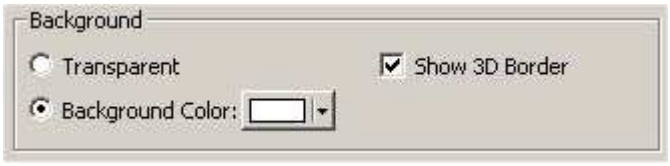
SPIN CONTROL

Some numeric entry boxes have a spin (up/down) control attached. These controls make it easy to change values, and ensure that the number stays in a valid range. You can type in a number, or use the arrows to increment or decrement the value.



OBJECT BACKGROUND

On certain objects, the background can be made transparent. If a solid background color is chosen instead, a border may optionally be added.

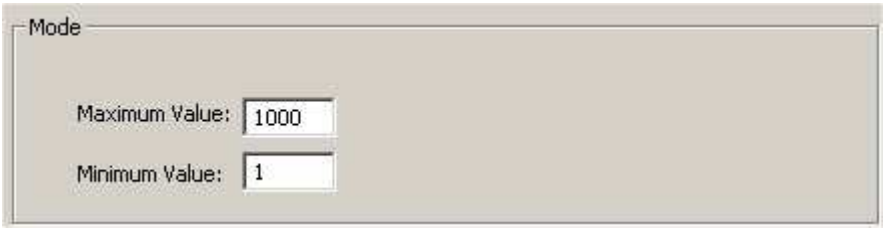


SCALE MODE

Several objects have both linear and logarithmic types available on the palette. These operate in much the same way, and their configuration dialogs are very similar. The primary difference between linear and logarithmic objects is their scale mode.

Logarithmic

For logarithmic meters and gauges, the scale is simply defined by the Minimum and Maximum Values. Remember that 0 is invalid for logarithmic.



Linear

For Linear meters and gauges the scale mode provides two choices for displaying the tick marks and labels of the scale: Fixed Scale or Auto Scale. This concept can be confusing at first. *Fixed Scale* focuses on absolute endpoints, and *Auto Scale* focuses on the density of tick marks.

FIXED SCALE

The Minimum Value and Maximum Value must be specified and will never change. The number of Major and Minor Ticks can still be modified between those endpoints, and the major ticks will be automatically labeled. If the Probe Point data exceeds the maximum, it will simply show the color bar extended all the way to the Maximum end.

AUTO SCALE

This is set to automatically rescale as it receives values outside the present Min/Max range. The endpoints will include all data received since the last time the endpoints were reset (refer to *Reset* Button on Min/Max tab). The endpoints are adjusted automatically to optimize tick mark labels. The User specifies the label density (number of visible tick marks) instead of the endpoints. When it rescales it automatically relabels the tick marks.

To set the starting points, switch to *Fixed Scale* to enable Minimum Value and Maximum Value and exit the Configuration Dialog to save the Values. Then reopen the dialog and reselect Auto Scale once they are set correctly. Remember they may change automatically with the first Probe Point data received when in Auto Scale mode.

If the Object has Color Bands, the Endpoints of each Color Band must be within the Scale. If Auto Scale is chosen it will include all enabled Color Band Endpoints.

NUMERIC LABELS

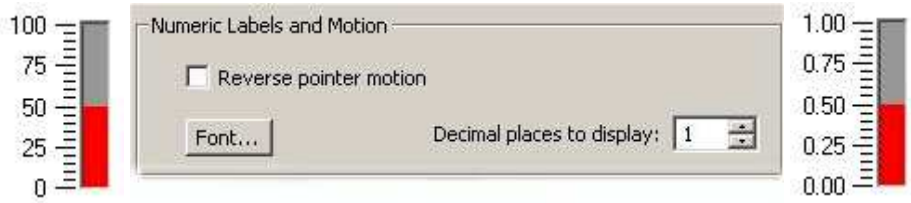
This is used to modify the size and Font of the Numbers that label the Major Tick Marks.

Font

The Font uses the standard Font Dialog.

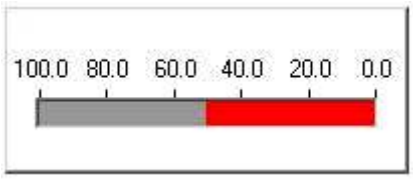
Decimal places to Display

The numeric labels of many Objects are also readily configurable. For example, the numbers on a gauge that runs from 0 to 100 might use zero decimal places to label the major ticks, while another gauge that expects values from 0 to 1 might use two decimal places.



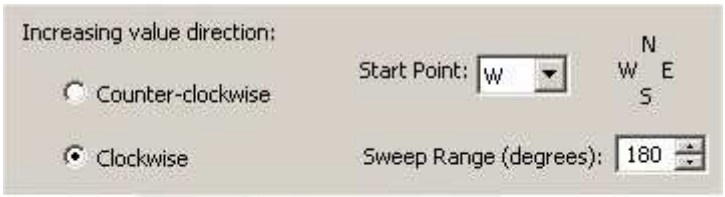
Reverse pointer motion

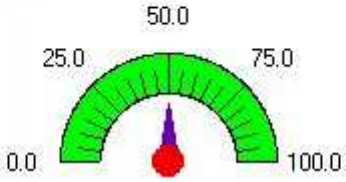
Checking *Reverse label order* allows the numbering to progress from top to bottom (or from right to left). The Thermometer does not offer this option.



COMPASS

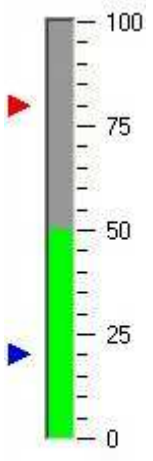
Certain objects display their data in a rotary manner. In order to simplify selection of allowed locations on the circle, compass selection is provided. In the example below, to display a half-circle gauge only, the start point (Minimum) is set to West and the end point (*Sweep Range*) is 180 degrees from there, moving clockwise.

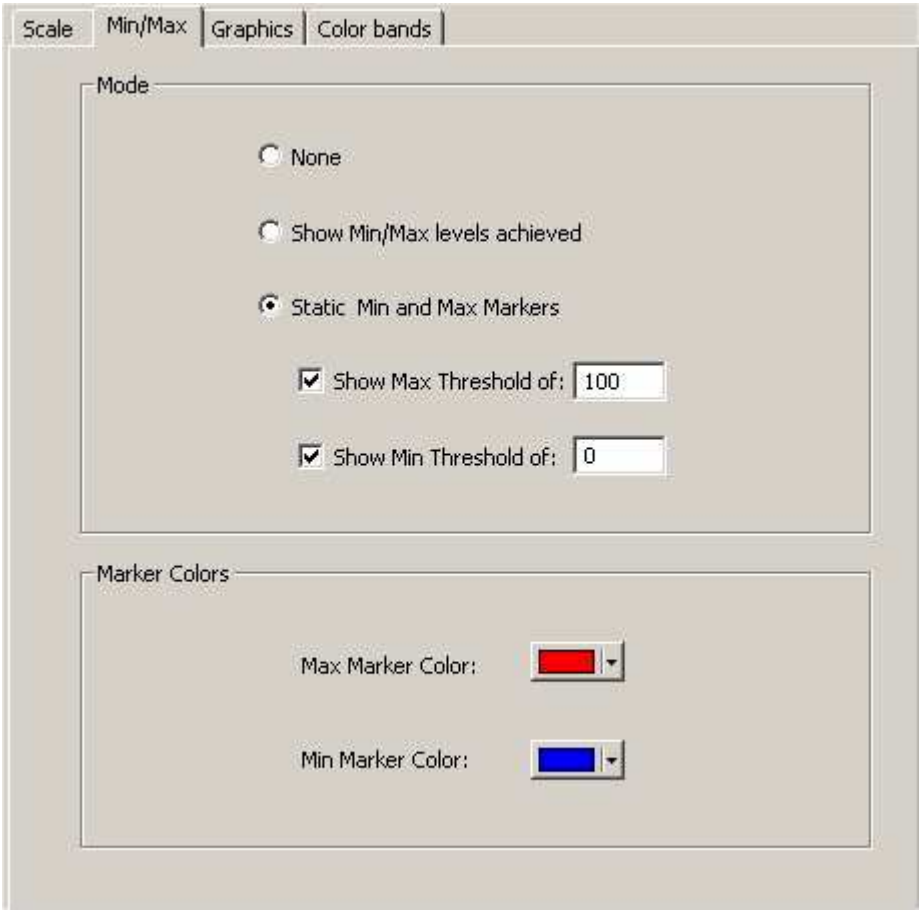




MIN/MAX TAB

Each of the objects with a Min/Max tab in the configuration dialog has a pair of markers that can be set along the scale to provide some historical information. They can be completely hidden, or can be set in place according to one of two modes. They appear as two small triangles, on the side opposite the tick marks, as shown below.



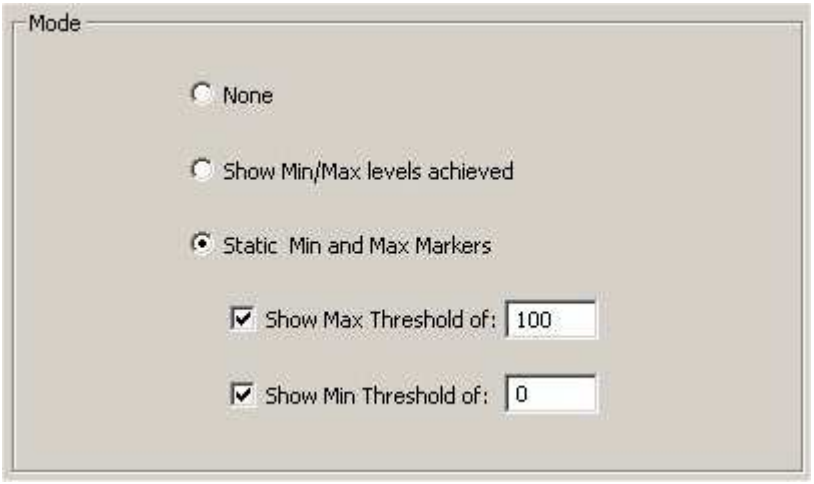


Marker Colors

The color of each Marker can be modified using Color Dialog.

Static Min and Max Marker

For example, if the scale is set to Autoscale, *Static Min and Max Markers* could denote the original endpoints, to emphasize how far they were exceeded.



Show Min/Max levels achieved

Alternatively, if scale is set to Fixed, then *Show Min/Max levels achieved* provides an idea of how much the data has been drifting within the endpoints. The *Reset* button will move both Min and Max Markers to the current value of the probe point data.

ANGULAR GAUGES (LINEAR AND LOGARITHMIC)

Angular Gauge Objects display Analog data on a dial, with optional color bands.

There are two types of Angular Gauge icons (Linear and Logarithmic) on the palette. The Configuration Dialog is the same for both of them, except for Mode on the Scale tab.

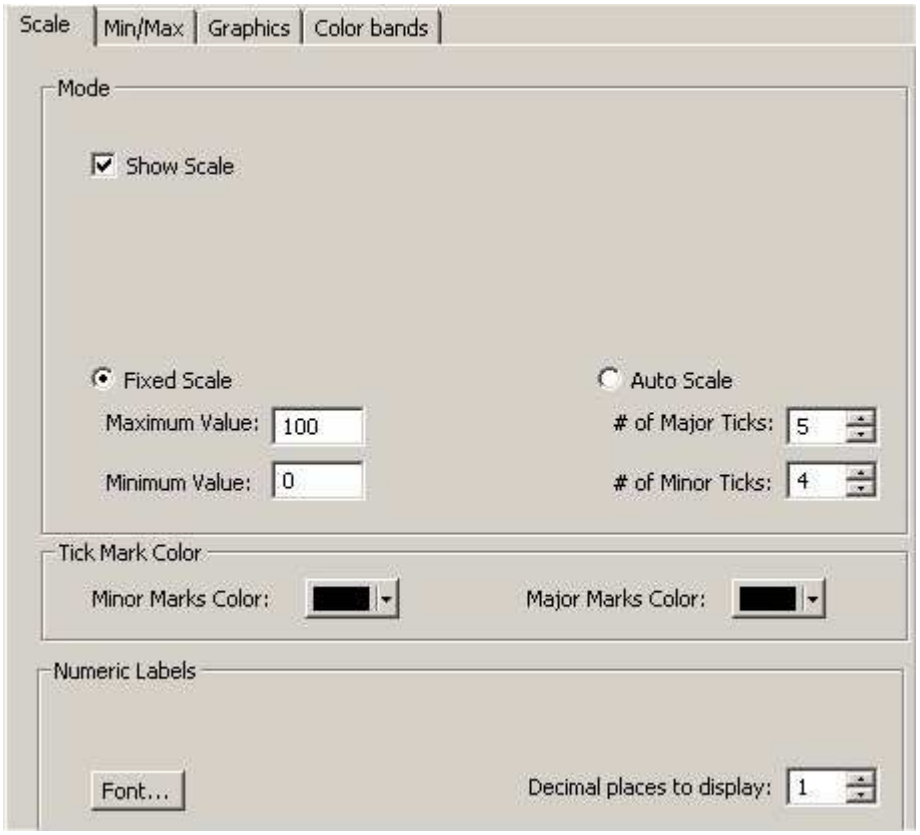
Note: Logarithmic Gauges can only display numbers greater than zero.

PROBE POINT LINK

Described in Probe Point Link.

SCALE TAB

For Angular Gauge Objects, the one difference between Linear and Logarithmic Properties is the Scale Mode. This is an example of a Linear Scale tab.



Linear Mode

FIXED SCALE
Described in Linear Scale Mode above.

AUTO SCALE
Described in Linear Scale Mode above.

SHOW SCALE

If this checkbox is not checked, there will be no tick marks and no numeric labels. If Fixed Scale was selected, the Minimum Value and Maximum Value will still be adjustable. The endpoints will be used as limits for the color bar, but those numbers will not appear.

Logarithmic Mode

Described in Scale Mode.

Tick Mark Color

Select the color of the tick mark lines, as described in Color Dialog.

Numeric Labels

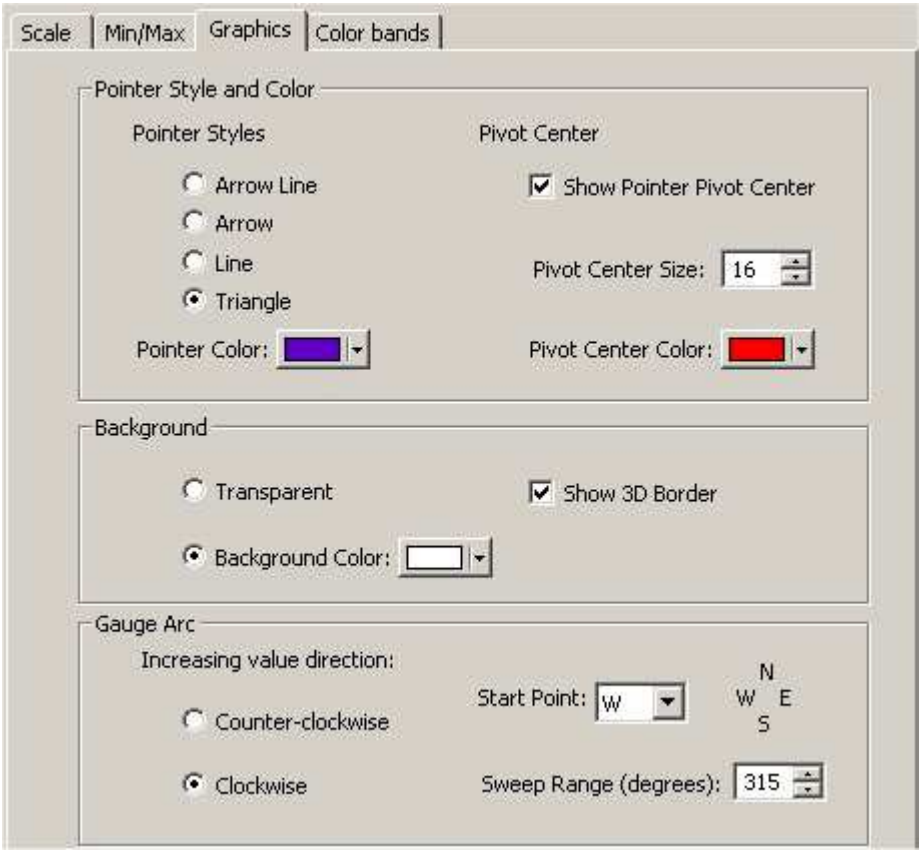
Font and Decimal places to display are described in Numeric Labels.

MIN/MAX TAB

An extra pair of Markers for Minimum and Maximum Values within the Scale Range can be configured from the Min_Max_Tab.

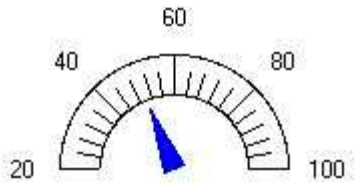
GRAPHICS TAB

The Graphics tab of the Configuration Dialog for the Angular Gauge offers many options. The Pointer, the Background, the Arc and the Pivot Center each have several choices.



Pointer

Choose a color (Color Dialog) and shape for the pointer. Bear in mind that it will stay on the inside edge of the arc.

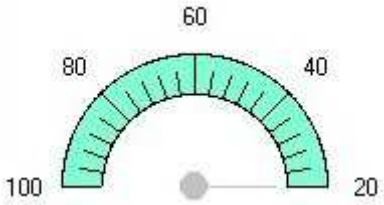


Background

The background of the Object can be colored or transparent, as described in Object Background.

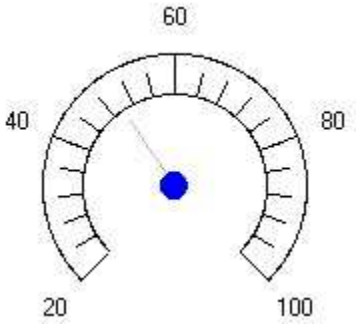
Arc

The Arc can be labeled clockwise or counter-clockwise. Its starting point and range are set as described under *Compass* in the Common Properties section.



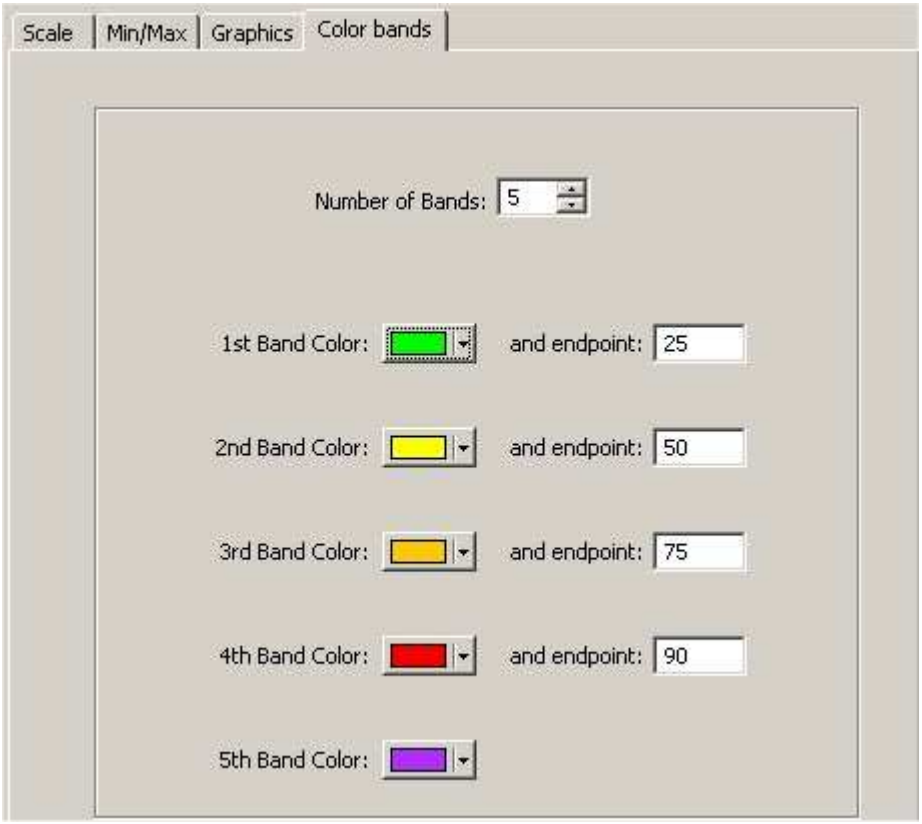
Pivot Center

The pivot center is optional. Its size and color (Color Dialog) are also chosen from the Graphics tab.

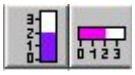


COLOR BANDS TAB

The Angular gauge provides up to 5 Color Bands.



BAR METERS (VERTICAL AND HORIZONTAL)



The Bar Meter objects display analog data. They fill a shaft from the Origin point to the current Value. There are no color bands for the Bar Meters, however they do offer an alternate color when the selected threshold is exceeded.

There are two types of Bar Meter icons on the palette, Horizontal and Vertical. The configuration dialog is the same for both of them, except for scale on the scale tab.

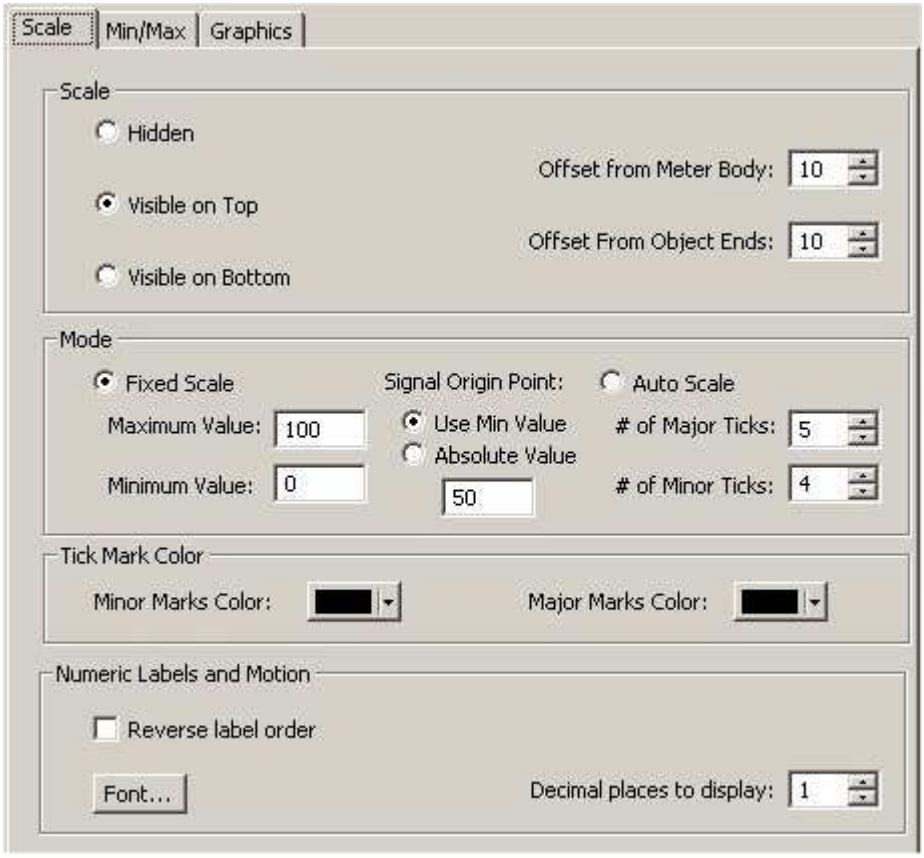
Note: Logarithmic Gauges can only display numbers greater than zero.

PROBE POINT LINK

Described in Probe Point Link.

SCALE TAB

The Scale Tab has 4 sections: Scale, Mode, Tick Mark Color and Numeric Labels and Motion. This is the Scale Tab for the Horizontal Bar Meter.



Scale

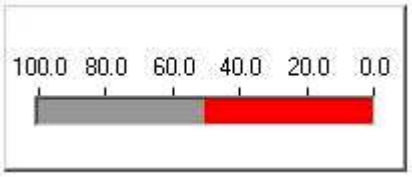
The Scale section determines placement of the Tick Marks.

RADIO BUTTONS

Decide whether the Tick Marks and Numeric Labels should appear on the *Top* (Left for Vertical), *Bottom* (Right) or not at all (*Hidden*).

OFFSET FROM METER BODY

The spacing can be adjusted with *Offset from Meter Body.* At zero, the Minor Ticks are not visible.



OFFSET FROM OBJECT ENDS

For the Bar Meters, only the Horizontal one can adjust the ends. This is used to make room for wide numbers on the endpoints, such as 123.45

Mode

For the Mode, select either Fixed or Auto and then set Signal Origin Point to denote where the bar begins filling.

FIXED SCALE

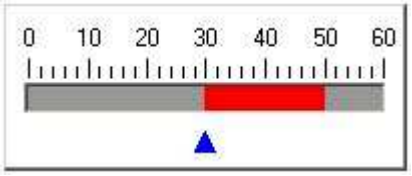
Described in Linear Scale Mode above.

AUTO SCALE

Described in Linear Scale Mode above.

SIGNAL ORIGIN POINT

The Bar Meter can fill from any designated Origin Point, not just from the Minimum end. In the example below, the Origin is at 30, so a Value of 50 fills the Bar Meter from 30 up to 50. For Values below the Origin point, it will fill from there to the Origin, (i.e. from 15 to 30).



.

Tick Mark Color

Select the color of the tick mark lines, as described in Color Dialog.

Numeric Labels and Motion

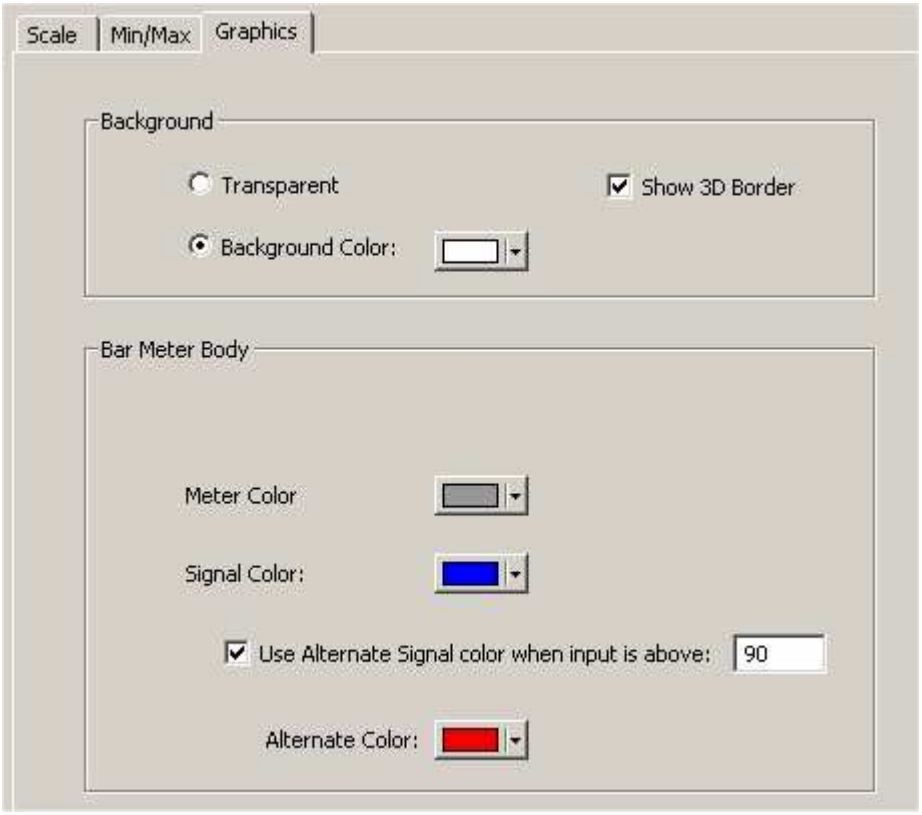
These parameters are described in Numeric Labels.

MIN/MAX TAB

An extra pair of Markers for Minimum and Maximum Values within the Scale Range can be configured from the Min_Max_Tab.

GRAPHICS TAB

The Graphics Tab is used to modify both the Background and the Body of the Bar Meter.



Background

The background behind the Tick Marks and Numeric Labels can be colored or transparent, as described in Object Background.

Bar Meter Body

This provides the capability to modify colors inside the Bar Meter itself.

METER COLOR AND SIGNAL COLOR

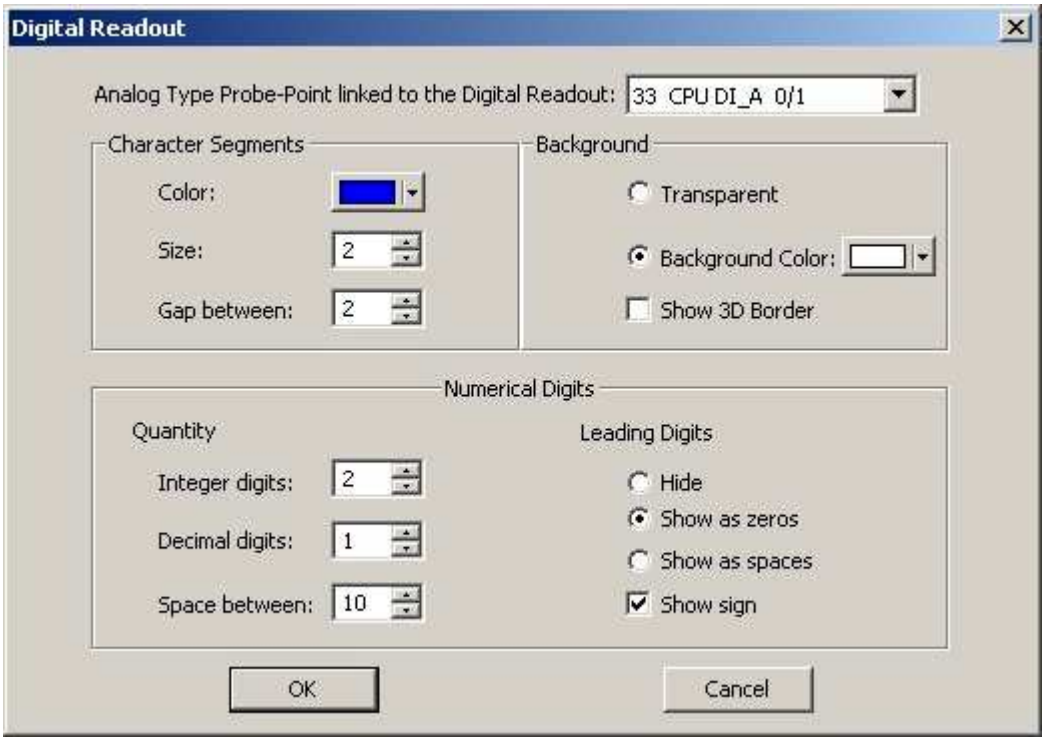
The signal color is the fill, and the Meter color is the body of the Bar Meter behind it. All colors use the standard pop-up Color Dialog.

ALTERNATE COLOR

Having a different color when the Value exceeds the designated threshold is particularly useful when the *Signal Origin Point* from the Scale tab matches the threshold number for *Alternate Signal* color. The color change is also is beneficial when used as a warning.

DIGITAL READOUT

The digital readout displays a number in a font that resembles the segmented numbers on a digital clock. Its configuration dialog has several sections of parameters: Background, Character Segments, and two more sections under Numerical Digits.



ANALOG TYPE PROBE POINT LINKED TO THE DIGITAL READOUT

Described in Probe Point Link.

BACKGROUND

The background behind the digits can be colored or transparent, as described in Object Background.

CHARACTER SEGMENTS

All *Colors* use the standard pop-up Color Dialog.

The *Size* varies from 1 to 30, the latter of which can be read from across a large room.

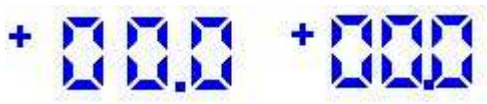
The *Gap between* segments of a digit changes the readability of it.

All of the number entry boxes on this dialog use Spin Controls.

QUANTITY

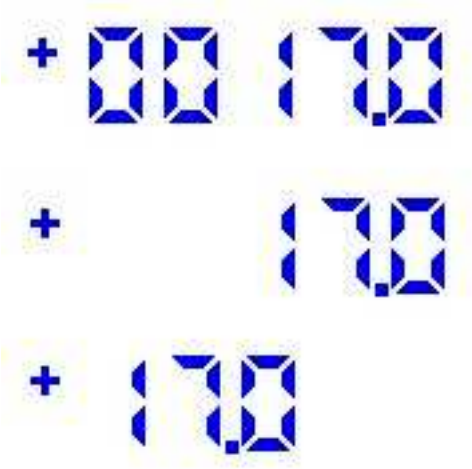
The example above has 2 *Integer digits* (left of the decimal point) and one *Decimal digit* (to the right of the decimal point).

The *Space between* digits also affects readability.



LEADING DIGITS

Leading digits are to the left of the decimal point. For example, if Integer digits was set to 4 but the Value is only 17.0, then choose whether leading digits should be zeros (show digits in all places), spaces (to keep the box the same size) or hidden (adjusts to the number of digits displayed).



If *Show sign* is not checked, even negative numbers will have no sign.

HYPERLINK

This object provides a link to another Custom Web Page in the Program Net, or a link to an Internet URL (Universal Resource Locator). The *Link Label* text will appear where the hyperlink object is placed on the Web Page.

BACKGROUND

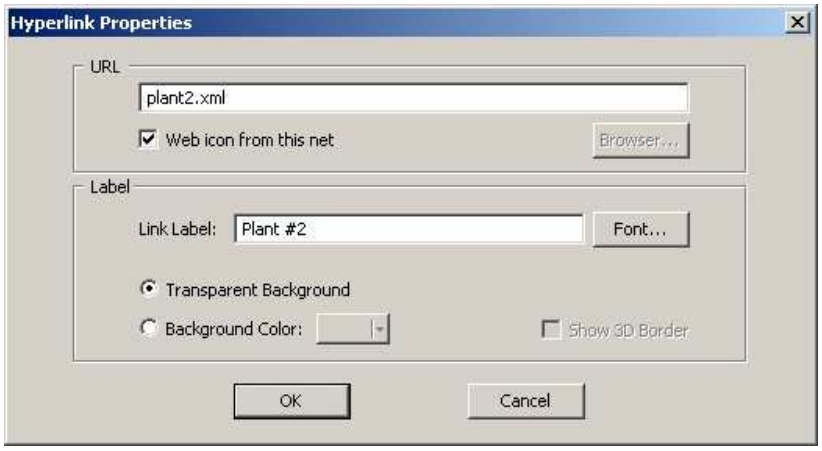
The background behind the digits can be colored or transparent, as described in Object Background.

FONT

The default Font is underlined and blue, to indicate that it is a clickable hyperlink, but this may be modified using the *Font* button, as explained in Font Dialog.

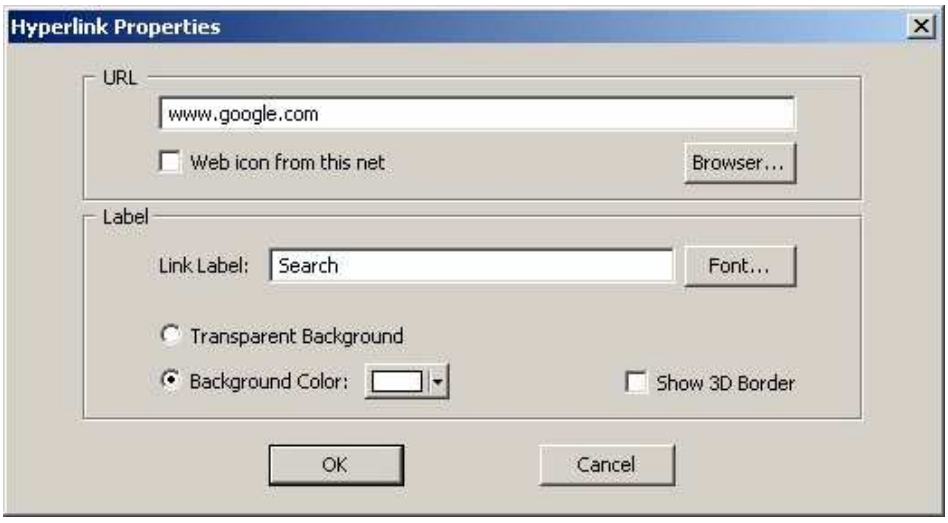
PROGRAM NET WEB ICON

Be sure to check *Web icon from the net* if the hyperlink refers to a custom web page in the Program Net.



INTERNET URL

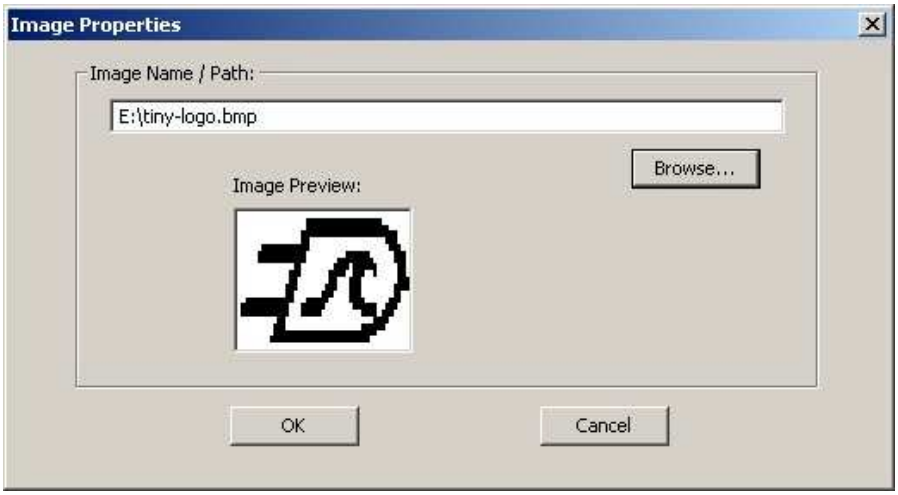
Be sure to leave *Web icon from the net unchecked* if the hyperlink refers to a web page on the Internet.



When a URL has been entered, the *Browser* button provides a convenient way to check that it is typed in correctly, by activating the Standard Browser (i.e. FireFox, NetScape, Iexplorer, etc.) with that URL address.

IMAGE

The image object may be used to display a picture, such as a logo, that can be superimposed over the background. This type of object is not associated with any Probe Point.



Images that are associated with custom web page will uploaded to the Logger, so it is wise to reduce or limit image sizes where possible. A picture saved as a *.JPG file will generally take up less space than one saved as a *.BMP. Many image-editing applications also permit image *resizing* to reduce the amount of space image files takes up.

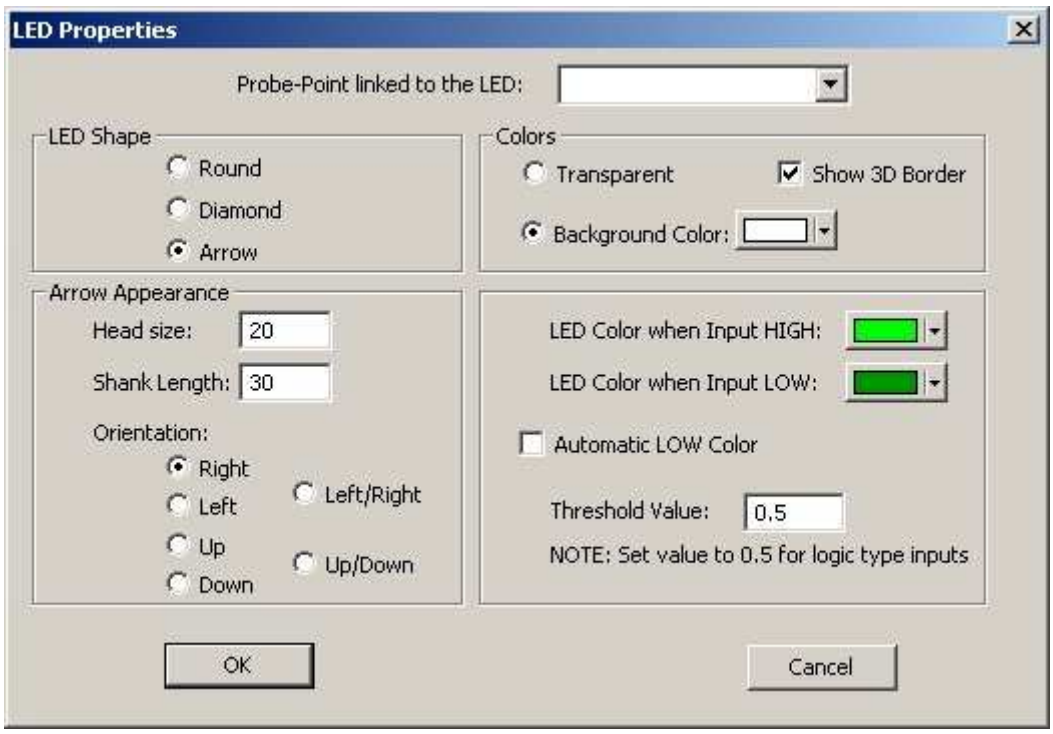
Each image should be less than 180 KB, and the total space for all images in all custom web pages of a Program Net should be limited to 600 KB total.

When a Custom Web Page is saved, it makes a copy of each of its images (including the background) in the same subdirectory where the *.XML file is saved. So if the original image is changed after the web page has been saved, the web page will still show a copy of the original image. Reopening the image object's configuration dialog will show the pathname of the file it is now using.

LED

The LED object displays only 2 conditions, however works with analog data as well as with Logic (high/low) data by assigning a *Threshold Value.*

The shape of the LED object may be modified – the configuration dialog below shows a section (Arrow Appearance) that only appears when the *Arrow* LED shape is selected.



PROBE POINT LINK

This is described in the Probe Point Link section.

LED SHAPE

One of three shapes may be selected for the LED object.

COLORS

The first section of colors is standard for most of the objects, and is described in Object Background.

The color of the LED depends on the value of the associated probe point data. When the value from the Probe Point is higher than the defined Threshold, the *HIGH* color will be shown. When the Value is lower than the threshold, the *LOW* color will be shown.

When the *Automatic LOW color* option is selected, the LOW color is generated automatically from the HIGH color. This color is typically a few shades darker than the high color.

The *Threshold Value* specifies the crossover point between HIGH and LOW. For Probe Points with Logic data, use a value of 0.5 so that 1 will be HIGH and 0 will be LOW.

ARROW APPEARANCE

The arrow is directional, so a direction must be chosen. Also, because this is a two-part object, the relative sizes must be selected.

Head Size and Shank Length

The head size actually affects the width of the shaft as well as the length and width of the arrow head.

Head	Shaft
20	10
8	50
8	30
20	30
50	30

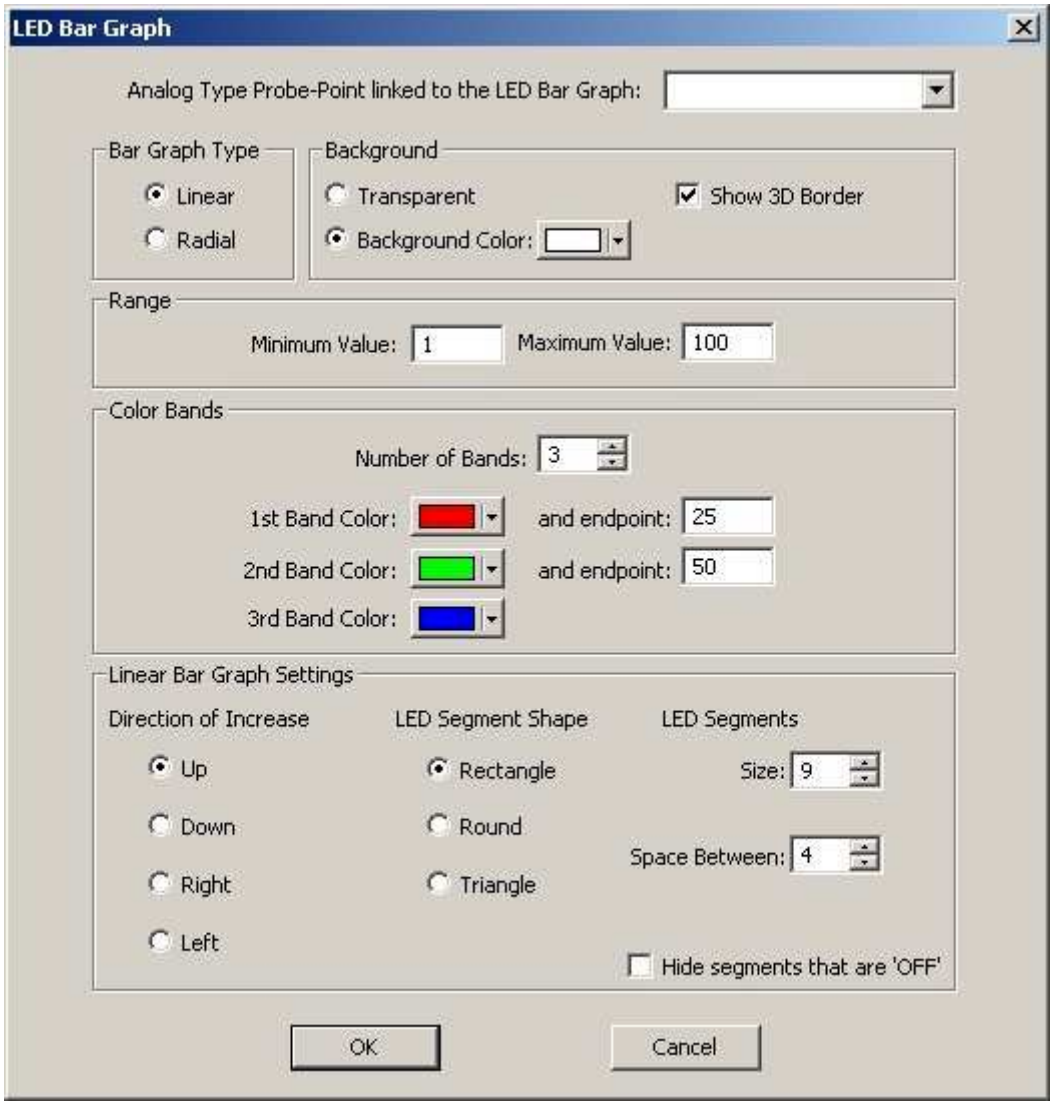
Orientation

The arrow LED does not have any diagonal position. There are 4 standard positions to choose from. There is also a double-ended option, which may be used both vertically and horizontally.

LED BAR GRAPH

The LED Bar Graph displays sequences of LED segments within a bar. These segments are illuminated from the minimum value of the scale to the current value of the Probe Point. The remainder of the segments are darkened.

There are 5 sections to the LED Bar Graph configuration dialog: Background, Bar Graph Type, Range, Color Bands, and a Graph Settings section that changes depending on the Bar Graph Type selected.



PROBE POINT LINK

This is described in the Probe Point Link section.

BACKGROUND

The background behind the segments can be colored or transparent, as described in the Object Background section.

RANGE

This is used to set the Minimum and Maximum values for the display.

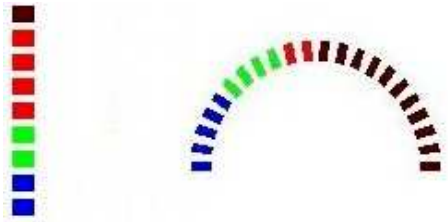
Note: Color Band endpoints must be within the Range.

COLOR BANDS

This standard parameter is described in the Color Bands section.

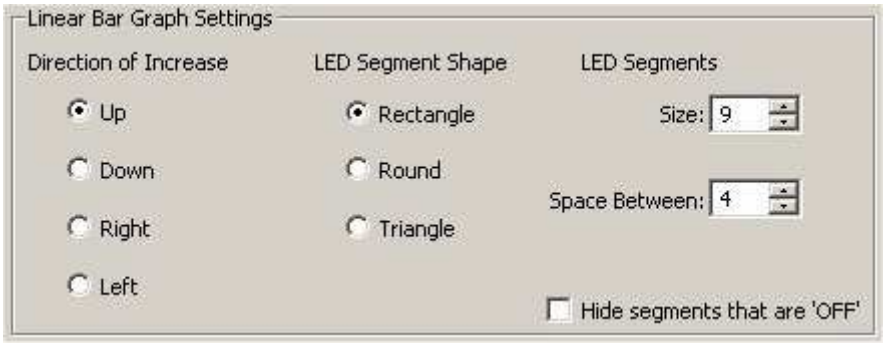
BAR GRAPH TYPE

Segments may be laid out in a linear or radial fashion.



LINEAR BAR GRAPH SETTINGS

The linear settings can be used to modify the direction of the entire bar, as well as the shape, size and visibility of the individual segments.



Direction of Increase

This is used to select the direction of progression from Minimum to Maximum. If necessary, the object will automatically resize, reversing the height and width to guarantee that the direction moves along the greater of the dimensions. For example, if the dimensions of the object were Height = 20 cm and Width = 1 cm, selecting Right or Left will cause it to become Height = 1 cm and Width = 20 cm, after the configuration dialog closed.

LED Segment Shape

This allows the selection of a shape. Triangles will always point in the direction of increase.

LED Segments

The number of *Linear* segments and their width across the bar (i.e. height when the bar is horizontal) are calculated automatically, based on the total dimensions of the object. Both of these number entry boxes use Spin Controls.

SIZE

This adjusts the size of individual segments, in the direction of increase. Valid sizes are between 2 and 20. Choose a size small enough to give sufficient resolution for the total dimensions of the object.

SPACE BETWEEN

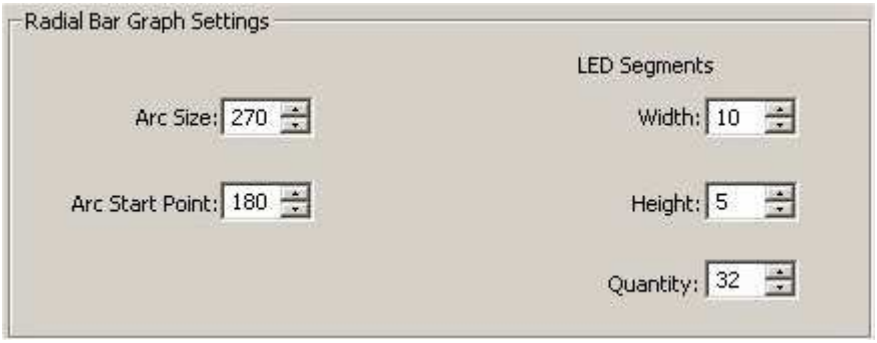
This adjusts the space between the individual segments, in the direction of increase. Valid values are between 1 and 10.

Hide Segments that are OFF

When this option is selected, it overrides the default behavior. Instead of automatically darkening segments between the current data value and the maximum value of the range, it makes these segments disappear.

RADIAL BAR GRAPH SETTINGS

The radial LED represents an arched bar of segments. The direction of progression from Minimum to Maximum is always clockwise. Its configuration dialog offers modification of parameters of the arc, as well as parameters of the individual segments. These number entry boxes use Spin Controls.



Arc Size

This allows the arc angle to be specified. Valid values are between 30 and 360 degrees.

Arc Start Point

0 is the right side (East), 90 is at the top (North) and 180 is the left side (West). The Arc will progress clockwise from the start point. Valid values are between 0 and 360.

Width

In line with the direction of increase along the arc, choose a width small enough to prevent segment overlap for the selected quantity and the total dimensions of the object. Valid values are between 2 and 100.

Height

This is the size of individual segments, in the direction from the inside to the outside edge of arc. Valid values for height are between 1 and 50.

Quantity

Choose a Quantity large enough to give sufficient resolution. Valid values for quantity are between 8 and 360.

> **Note:** Width may need to be adjusted when Quantity changes, to prevent Segments from overlapping.

LINEAR GAUGES (VERTICAL AND HORIZONTAL)

Linear Gauge objects display analog data on a straight shaft, with optional color bands.

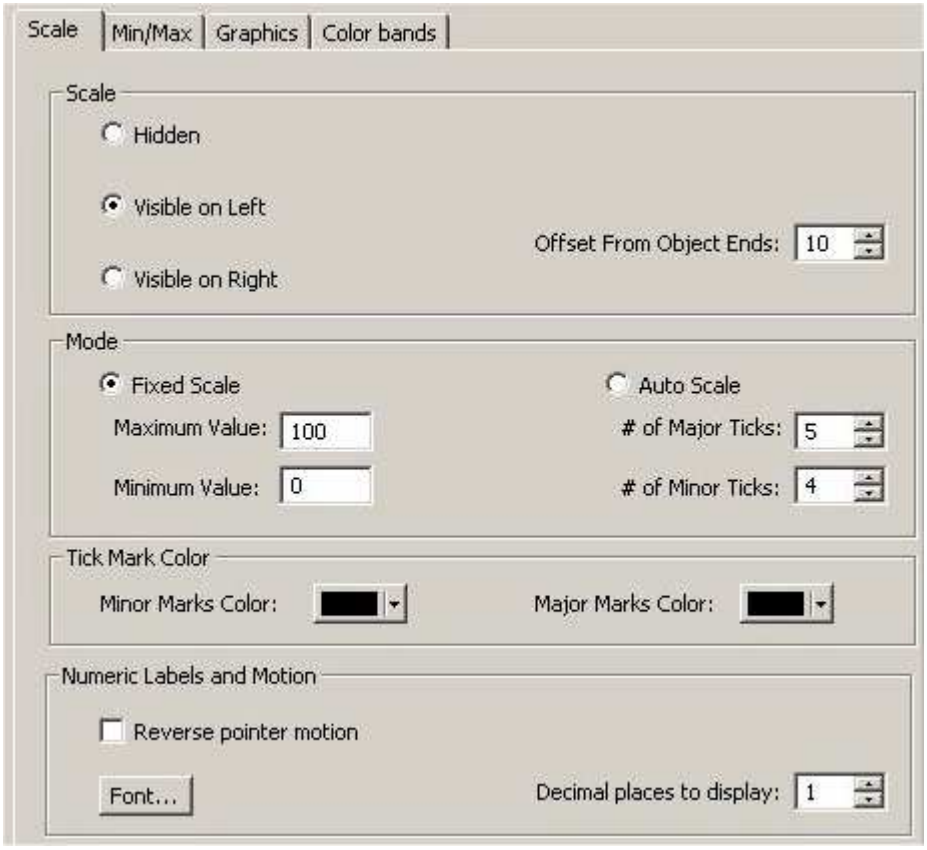
There are two types of Linear Gauge objects available on the palette- Horizontal and Vertical. The configuration dialog is about the same for both of these.

PROBE POINT LINK

This is described in the Probe Point Link section.

SCALE TAB

The Scale tab has 4 sections: Scale, Mode, Tick Mark Color and Numeric Labels and Motion. This is the scale tab for the vertical linear gauge.



Scale

The Scale section determines placement of the Tick Marks.

RADIO BUTTONS

These are used to select where the tick marks and numeric labels should appear - on the *Top* (Left for Vertical), *Bottom* (Right) or not at all (*Hidden*).

OFFSET FROM OBJECT ENDS

This is used to make room for numbers on the endpoints, such as 123.45

Mode

For the Mode, select either Fixed or Auto.

FIXED SCALE
This is described in the Linear Scale Mode section above.

AUTO SCALE
This is described in the Linear Scale Mode section above.

Tick Mark Color

Select the color of the tick mark lines, as described in the Color Dialog section.

Numeric Labels and Motion

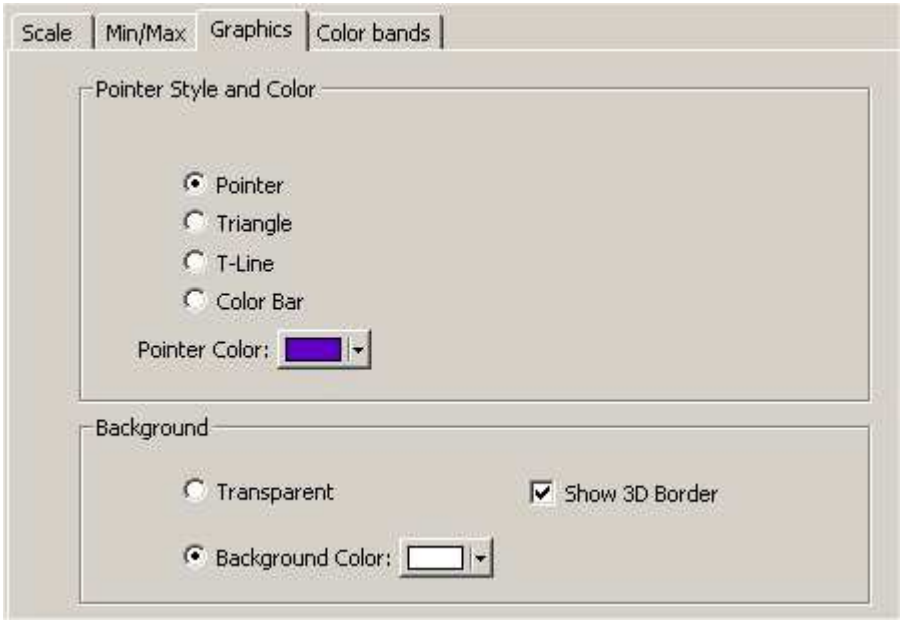
These parameters are described in the Numeric Labels section.

MIN/MAX TAB

An extra pair of markers for Minimum and Maximum values within the scale range can be configured from the Min_Max_Tab.

GRAPHICS TAB

The Graphics Tab is used to modify both the background and the pointer of the Linear Gauge.



Background

The background behind the tick marks and numeric labels can be colored or transparent, as described in the Object Background section.

Pointer Style and Color

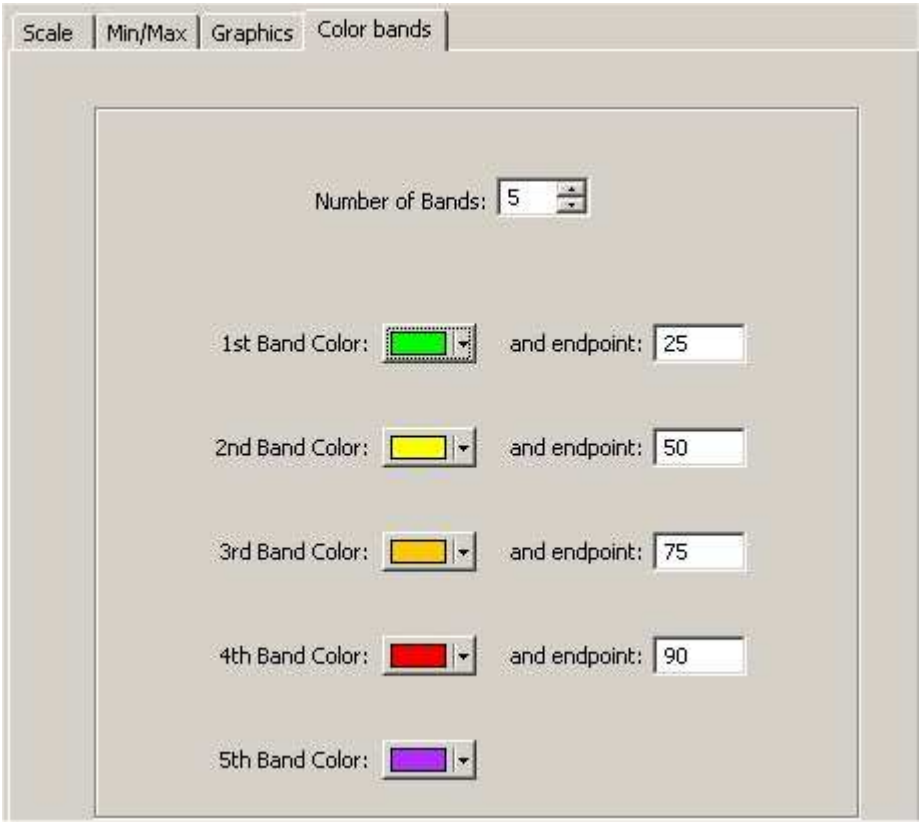
The 4 pointer options are shown here:

Pointer Triangle

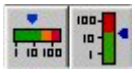
T-line Color Bar

COLOR BANDS TAB

The Linear Gauge provides up to 5 Color Bands.



LOGARITHMIC GAUGES (VERTICAL AND HORIZONTAL)



Logarithmic Gauge objects are used to display analog data on a straight shaft, with optional color bands.

There are two types of Logarithmic Gauge icons on the palette, Horizontal and Vertical. Their configuration dialogs is very similar for both.

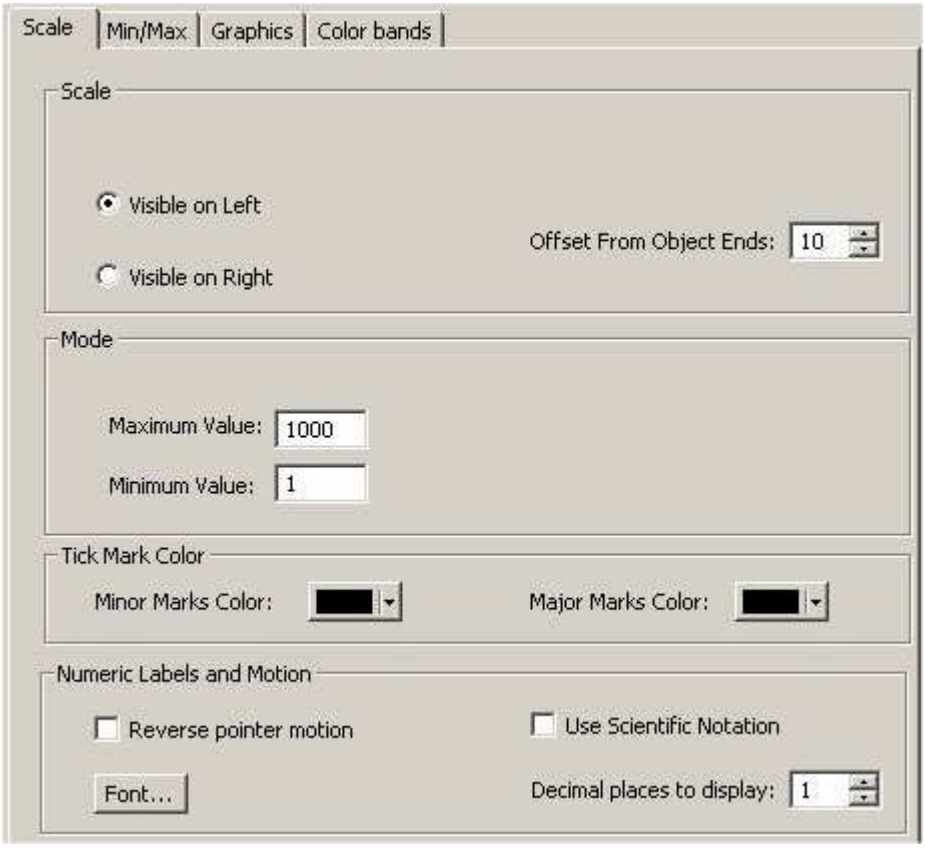
Note: Logarithmic Gauges can only display numbers greater than zero.

PROBE POINT LINK

This is described in the Probe Point Link section.

SCALE TAB

The Scale Tab has 4 sections: Scale, Mode, Tick Mark Color and Numeric Labels and Motion. This is the Scale tab for the Vertical Logarithmic Gauge.



Scale

The Scale section determines placement of the Tick Marks.

RADIO BUTTONS

This is used to select where the tick marks and numeric labels should appear - on the *Top* (Left for Vertical), *Bottom* (Right) or not at all (*Hidden*).

OFFSET FROM OBJECT ENDS
This is used to make room for numbers on the endpoints, such as 123.45

Mode

This is described in the Scale Mode section, under Logarithmic.

Tick Mark Color

Select the color of the tick mark lines, as described in the Color Dialog section.

Numeric Labels and Motion

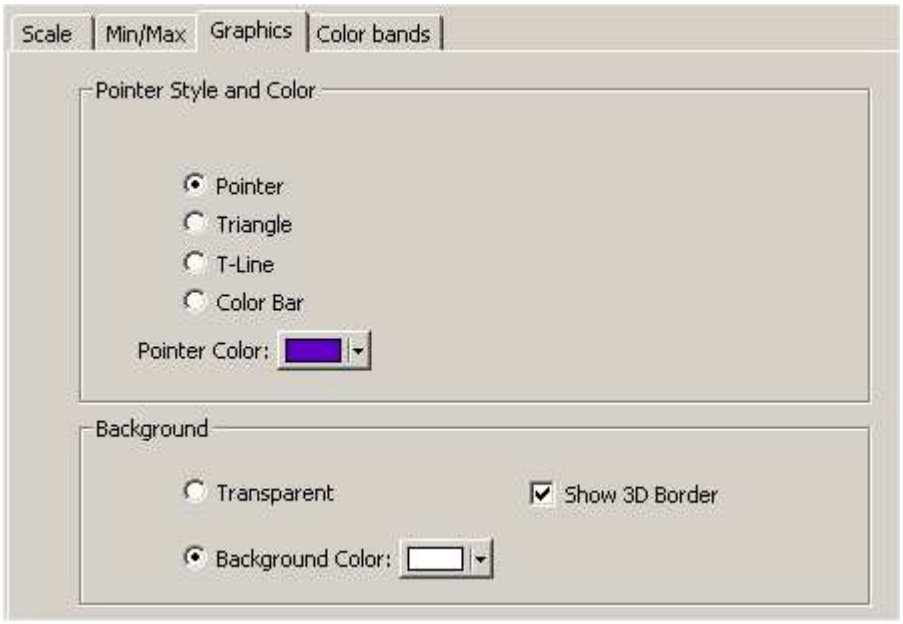
These parameters are described in the Numeric Labels section.

MIN/MAX TAB

An extra pair of Markers for Minimum and Maximum Values within the Scale Range can be configured from the Min_Max_Tab.

GRAPHICS TAB

The Graphics Tab is used to modify both the Background and the Pointer of the Linear Gauge.



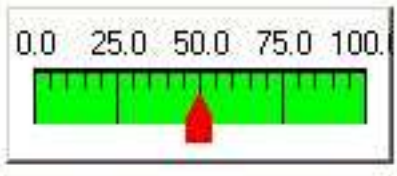
Background

The background behind the tick marks and numeric labels can be colored or transparent, as described in Object Background.

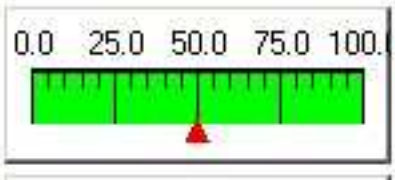
Pointer Style and Color

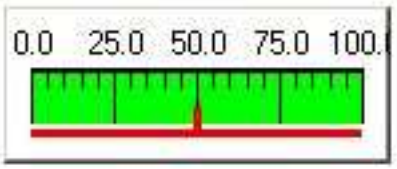
The 4 pointer options are shown here:

Pointer

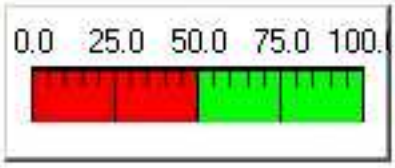


Triangle





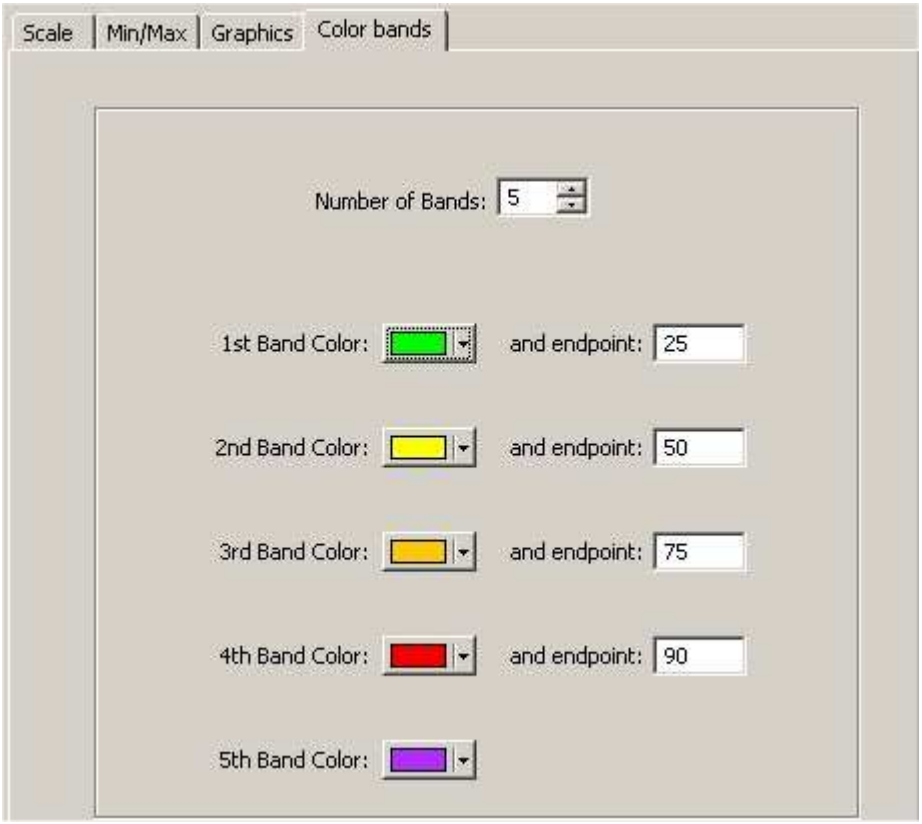
T-line



Color Bar

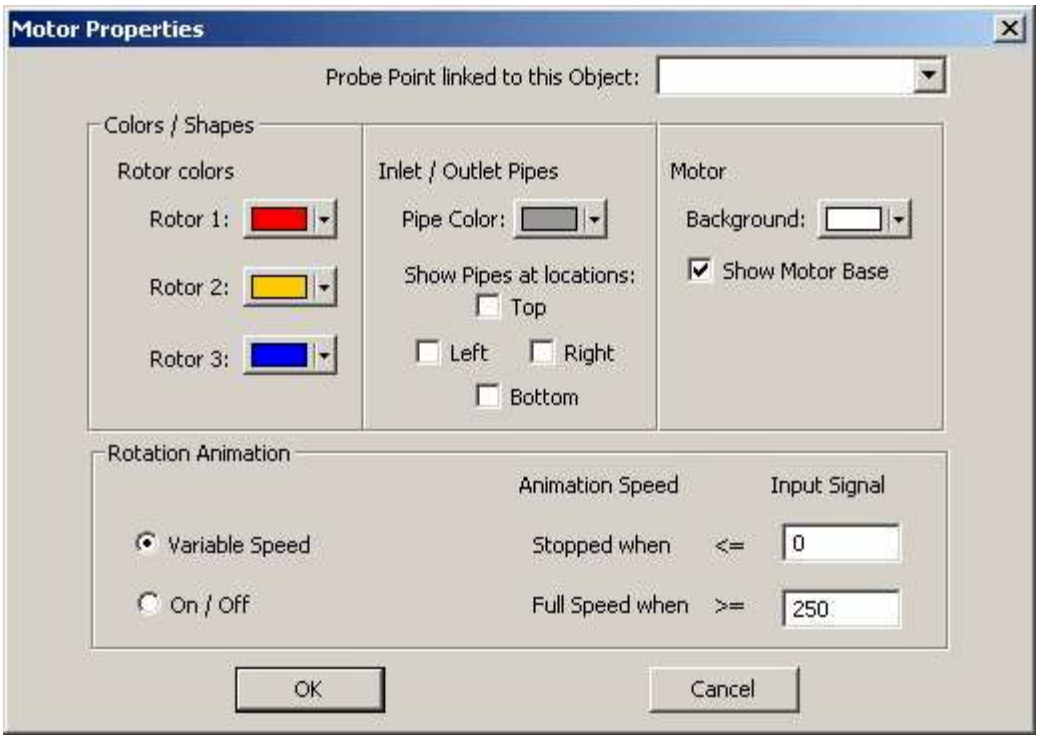
COLOR BANDS TAB

The Linear Gauge provides up to 5 Color Bands.



MOTOR

This is an animated object. It rotates colored rotors (“pie slices”) inside a circle. The speed of rotation indicates the data value. This configuration dialog has 4 sections: Colors, Pipes, Background and Animation.



PROBE POINT LINK

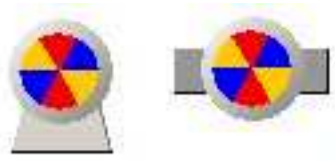
This is described in the Probe Point Link section.

COLORS

To show rotation, colored rotors are advanced around a circle. Choose 3 distinct colors, using the standard Color Dialog.

PIPES

The default Motor has a base with no pipes. When it is used to indicate flow rate, small pipe connections can be added to the image. Check the boxes to indicate where to add a pipe connection, then choose a color using the standard Color Dialog.



BACKGROUND

The background behind the Motor object can be colored or transparent, as described in the Object Background section.

If *Show Motor Base* is not checked, the base will not be shown.

ANIMATION

To show rotation, colored rotors are advanced around a circle. The speed of rotation depends on the data input signal from the Probe Point that is associated with this object. There are two modes of operation - one for Analog data and another for Logic (high/low) data.

Variable Speed

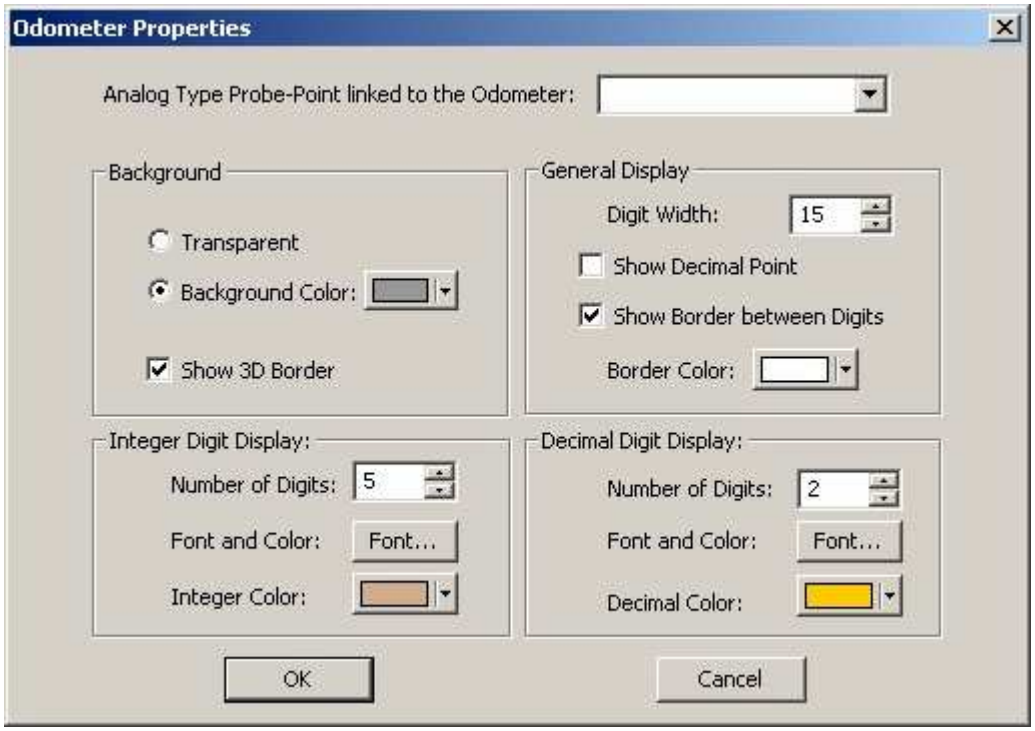
This is used for analog data. Enter the minimum value of the range for *Stopped when* and enter the maximum value for *Full Speed when.*

On/Off

This is primarily used for Logic data. There is a trick to showing analog data as On/Off, based on a Threshold number. With variable speed selected (to enable entry of min/max values), set *Stopped when* to your desired Threshold Value, then click the On/Off radio button. When the data exceeds the specified number, the motor will run full speed. Otherwise it will be completely stopped.

ODOMETER

The Odometer object makes analog numbers resemble a rolling odometer mileage display in a car. The configuration dialog covers 4 sections: Background, General, Integer Digits and Decimal Digits. The number entry boxes use Spin Controls.



PROBE POINT LINK

This is described in the Probe Point Link section.

BACKGROUND

The background behind the Odometer object can be colored or transparent, as described in the Object Background section.

GENERAL

Digit Width

The *Digit Width* setting controls the size of the column surrounding each digit. Valid values for this are between 1 and 30.

Show Decimal Point

If the Decimal Digits display is distinctly different from the Integer Digits display, *Show Decimal Point* may be left unchecked, so that no decimal point will be visible in the decimal place.

Show Border between Digits

Vertical bars will separate individual digits if *Show Border between Digits* is checked.

Border Color

Set the color of those border bars using the standard Color Dialog.

INTEGER DIGITS

Integer digits are the digits to the LEFT of the decimal point.

Number of Digits specifies the maximum expected number of integer digits. These are right justified and zero-filled if the value has fewer digits. If the value has more digits than specified, the most significant digits will not be shown.

The *Font and Color* of the integer digits can be selected using the standard Font Dialog.

Use the standard Color Dialog to set the *Integer Color* of the background within the columns for the integer digits.

DECIMAL DIGITS

Decimal Digits are the digits to the RIGHT of the decimal point.

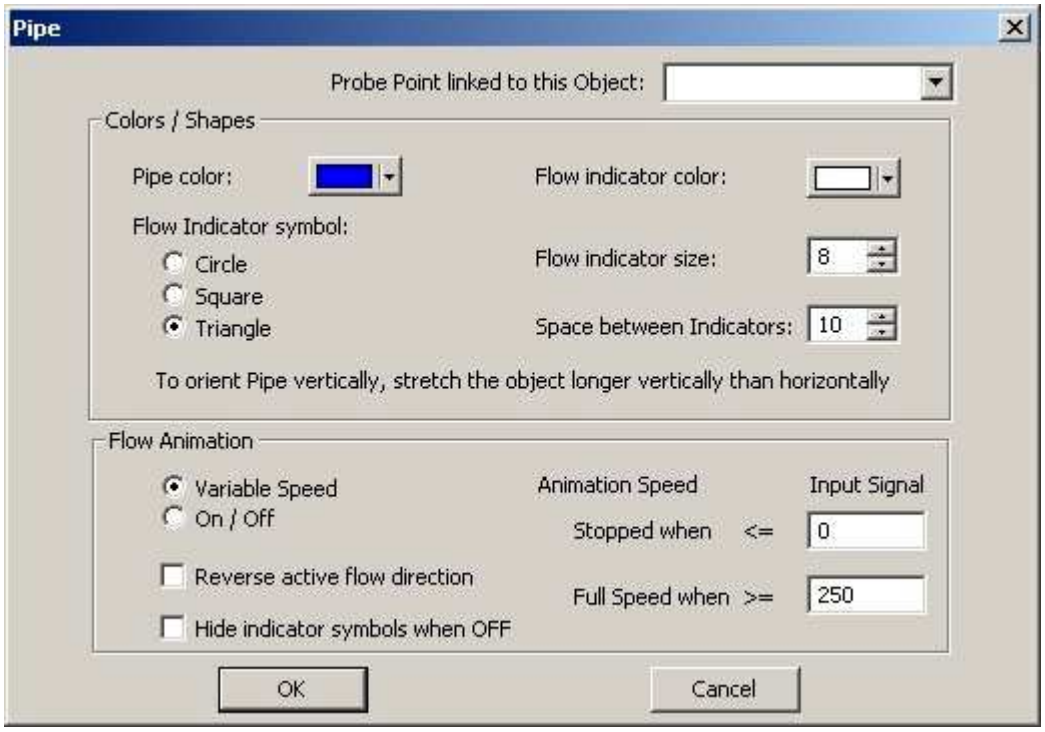
This *Number of Digits* specifies the maximum expected number of Decimal digits. If the value has greater precision than the number of digits specified, the extra digits are truncated.

Font and Color use the common Font Dialog to select the Decimal Digits.

The *Decimal Colo*r behind the Decimal Digits may be specified using the common Color Dialog.

PIPE

This is an animated object. The body of the pipe contains *Indicators* that move along the length of the pipe. The rate of the animation depends on the data value from the Probe Point associated with the object. Pipes flow vertically or horizontally, depending on which dimension of the object is longer.



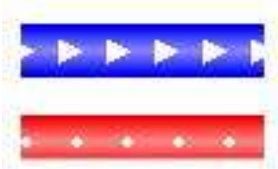
PROBE POINT LINK

This is described in the Probe Point Link section.

COLORS/SHAPES

This is used to specify the color of the Pipe itself and for the Flow Indicators inside it using common Color Dialogs.

Two of the 3 choices for the *Flow Indicator symbol* are shown below.



The size of the flow indicators and the space between them can be set using standard Spin Controls. The valid values for both *Flow Indicator Size* and the *Space between Indicators* range between 1 and 30.

FLOW ANIMATION

The speed of the flow animation can be used for Logic (high/low) data as well as for analog values. Select *Variable Speed* for analog data, and *On / Off* for Logic data. Any values less than the minimum will also stop the animation. Any values exceeding the maximum will show the animation at full speed.

On / Off assumes values of zero and 1.

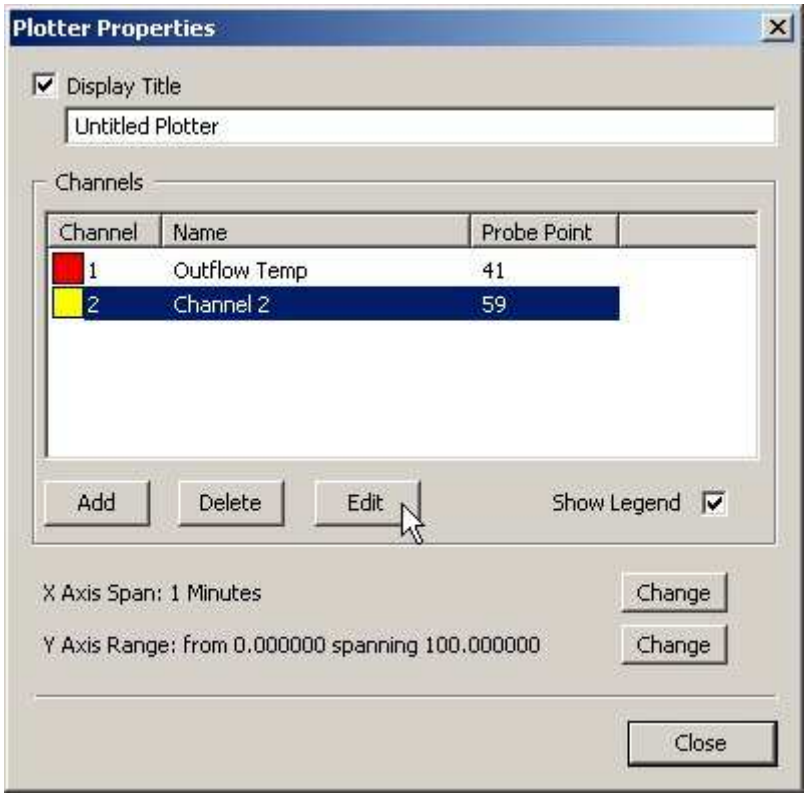
The range of expected values for *Variable Speed* can be set by entering the Minimum value into *Stopped when* <= ____ and the Maximum value into *Full Speed when* <= ____.

The default direction of flow is bottom-to-top when vertical, and left-to-right when horizontal. Check *Reverse active flow direction* to change this.

If *Hide indicator symbols when OFF* is selected, the pipe will be shown in a solid color, to emphasize the stopped condition.

PLOTTER OBJECT

The Plotter object is unique for several reasons. It is the only object that can track more than one Probe Point. It is also the only object that displays a history of values for each of its associated Probe Points over time. In addition, it has a built-in set of toolbar icons of its own.



Display Title

A checkbox is provided to permit display of a *Title*. The entry box at the top of this dialog is for the Title.

Show Legend

A checkbox is provided to permit display of a Legend. When selected a legend will be shown, indicating which color is associated with each Probe Point.

Channels

The Channel section includes a Channel list as well as Add, Delete and Edit buttons associated with it.

Channel Configuration

Instead of one drop-down selection list, the Plotter provides individual configuration for each channel that is added. Each channel represents a Probe Point.

The *Channel Name* entry box is the label that will appear in the legend for the current Channel data. This may be different from the name of the Probe Point if desired.

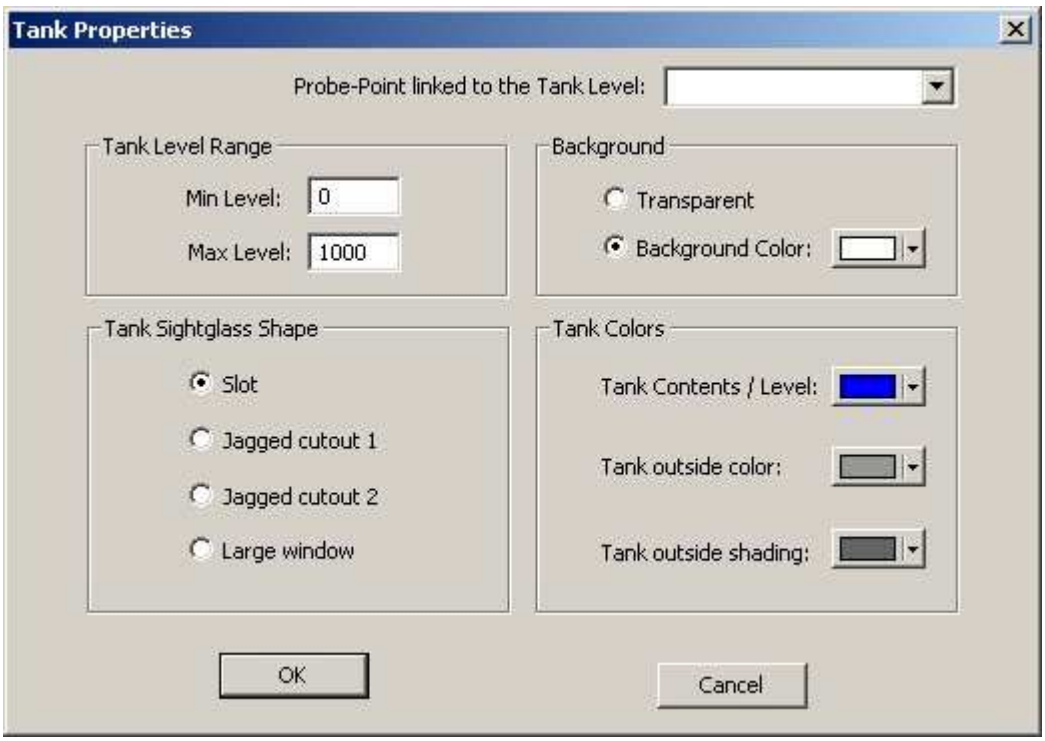
The *Probe Point* drop-down list allows selection of one of the Probe Points to be associated with the current channel.

Select a distinct *Trace color for each channel* using the common Color Dialog.

TANK LEVEL

Tank Level controls may be used to display analog data in a unique way.

The configuration dialog for the Tank Level control has a number of configurable areas: Level Range, Background, Shape and Colors



PROBE POINT LINK

This is described in the Probe Point Link section.

TANK LEVEL RANGE

This is used to enter the Minimum and Maximum Levels of expected values for the associated Probe Point. Any value that exceeds these levels will be displayed as the nearest range endpoint.

BACKGROUND

The Tank Level background may be colored or transparent, as described in the Object Background section. The background inside the tank will always be black. This setting only modifies the background outside the oval tank.

TANK SIGHTGLASS SHAPE

The four choices for Sightglass Shape are as follows:

Slot

Jagged cutout 1

Jagged cutout 2

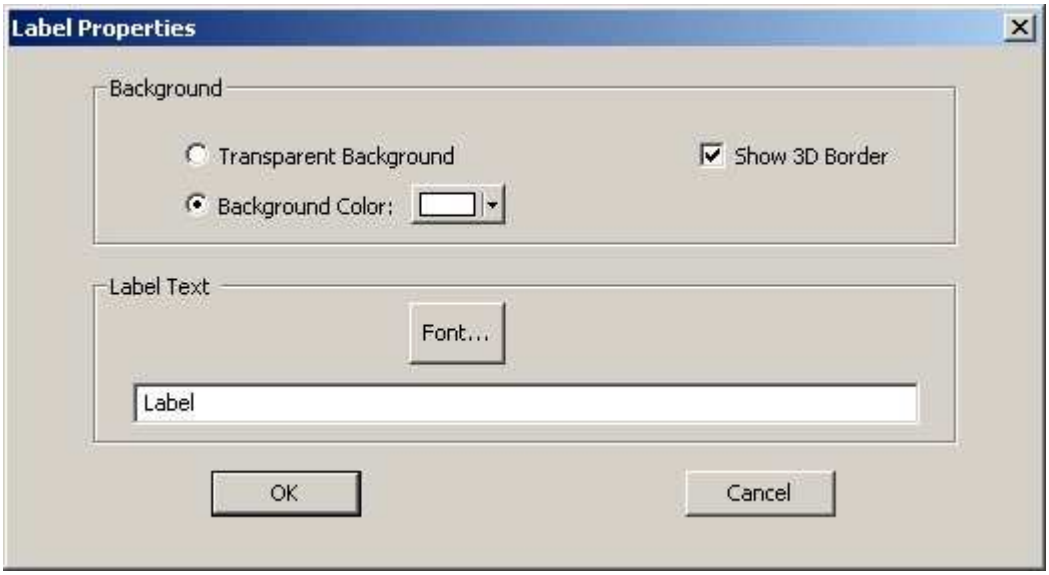
Large Window

TANK COLORS

Set the color of the *Tank Contents*/Level inside the tank using the common Color Dialog. Likewise set the *Tank outside color* and *Tank outside shading*. These two colors combine to give the body of the tank a three-dimensional aspect.

TEXT LABEL

The Text object provides labels or titles for a Web Page.



BACKGROUND

The background behind the object can be colored or transparent, as described in the Object Background section.

LABEL TEXT

The common Font Dialog may be used to modify the size and color of the Label.

The text box allows entry of the text to be displayed. Holding down the *Ctrl* key on the keyboard while also typing the *Enter* key will make the text start a new line.

> **Note:** to force a line break, use Ctrl-Enter

THERMOMETER

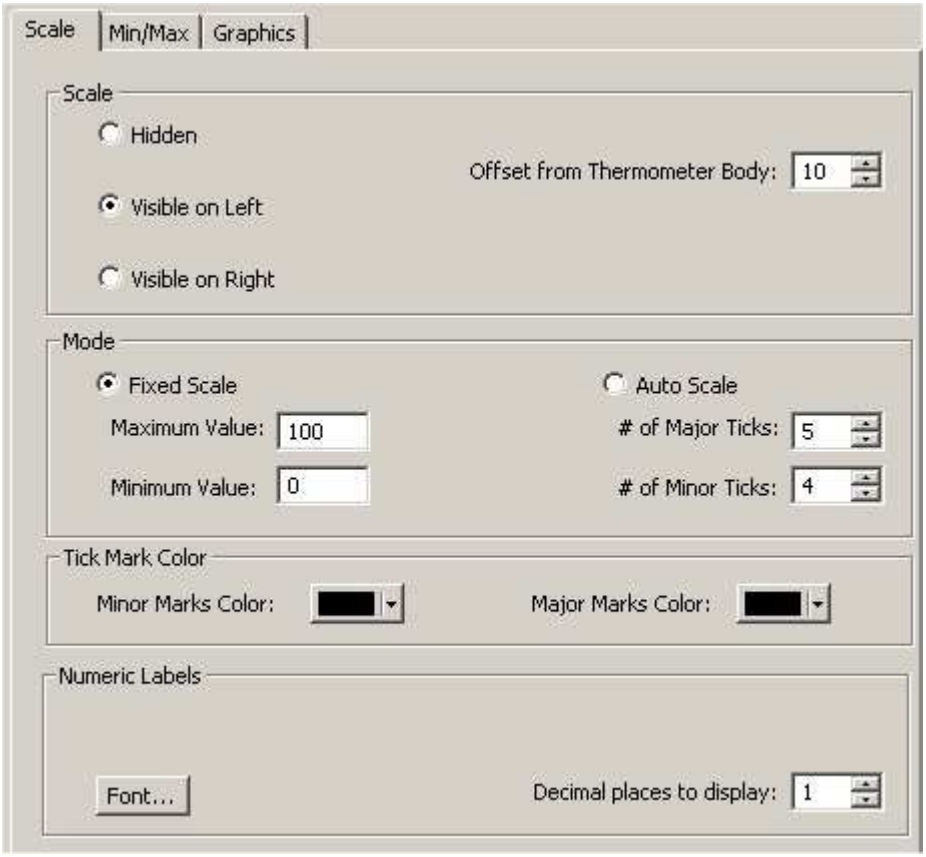
A Thermometer control normally shows a temperature, but this object could be linked to any analog Probe Point data. There are no color bands for a Thermometer object, however it does offer an alternate color for the entire control when the selected Threshold is exceeded.

PROBE POINT LINK

This is described in the Probe Point Link section.

SCALE TAB

The Scale Tab has 4 sections: Scale, Mode, Tick Mark Color and Numeric Labels and Motion. This is the Scale tab for the Thermometer.



Scale

The Scale section determines placement of the Tick Marks.

RADIO BUTTONS

This is used to specify where the tick marks and numeric labels should appear - on the *Left*, *Right* or not at all (*Hidden*).

OFFSET FROM THERMOMETER BODY

The spacing between the tick marks and the shaft of the thermometer can be adjusted using the *Offset from Thermometer Body* setting. This offset is actually from the center of the shaft, so changing the Thermometer Width on the Graphics tab will affect the space between the marks and the outer edge of the Thermometer. At zero, the Minor Ticks are usually not visible. At an offset of 100 (the maximum), the scale is far away from the thermometer.

Mode

This is described in the Linear Scale Mode section above.

Tick Mark Color

This area can be used to select the color of the tick mark lines, as described in the Color Dialog section.

Numeric Labels

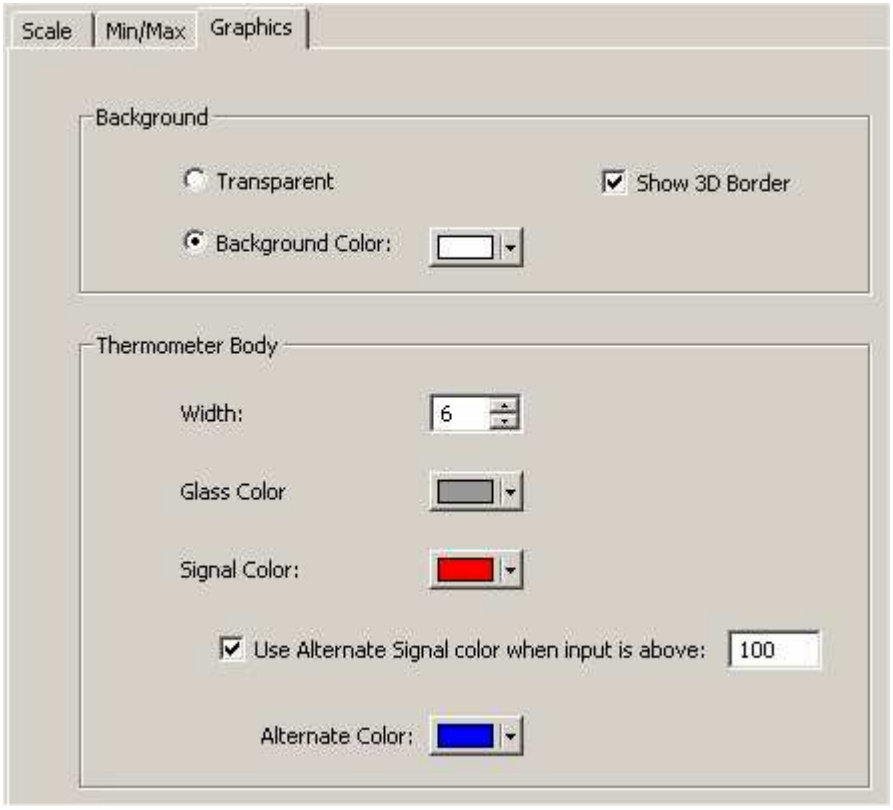
These parameters are described in the Numeric Labels section.

MIN/MAX TAB

An extra pair of markers for Minimum and Maximum values within the scale range can be configured using the Min_Max_Tab.

GRAPHICS TAB

The Graphics Tab is used to modify both the background and the body of the Thermometer.



Background

The background behind the tick marks and numeric labels can be colored or transparent, as described in the Object Background section.

Thermometer Body

This are provides the options to modify the visual appearance of the Thermometer.

Width

This sets the horizontal size of the bulb and shaft.

Glass Color and Signal Color

The Signal color is the fill, and the Glass color is the body of the Thermometer behind it. All colors use the common pop-up Color Dialog.

Use Alternate Signal Color…

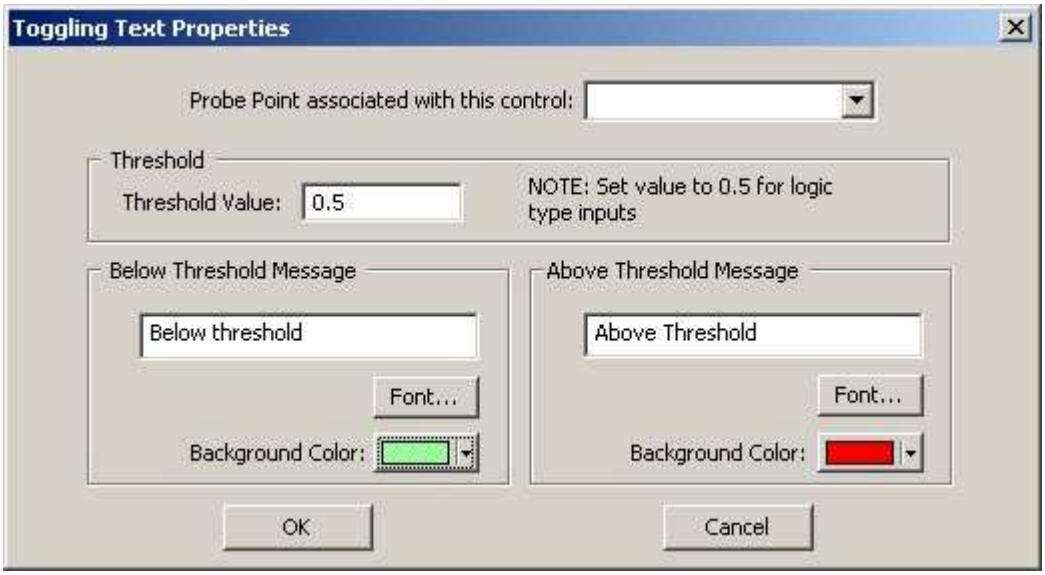
Color bands are not used for Thermometer controls, however, if this option is selected, the color of the bulb and fill will change from the *Signal* to *Alternate* color whenever the value from the Probe Point becomes greater than the value entered here (i.e. 100).

Alternate Color

Having a different color when the value exceeds the designated threshold is beneficial when used as a warning.

TOGGLING TEXT

This object and the Label object are both used to display text, however the Toggling Text object is linked to a Probe Point. Both its Font and Background may be changed when the specified Threshold value is exceeded.



PROBE POINT LINK

This is described in the Probe Point Link section.

THRESHOLD

This allows entry of the Threshold value, which will trigger the change from “Below” settings to “Above” settings.

> **Note:** this object can also be used for logic type data, by setting the Threshold to 0.5 (to catch the logic transition from 0 to 1)

BELOW/ABOVE THRESHOLD MESSAGE

“Above” and “Below” settings may be set so that they are easily distinguishable from each other. Whenever the data from the Probe Point remains below the Threshold value, the Text, Font and Background settings from *Below Threshold Message* will be used. When the value from the Probe Point exceeds the Threshold value, the message and settings from the *Above Threshold Message* will be shown.

Text Entry Box

This accepts a single line of text, limited to 80 characters.

Font

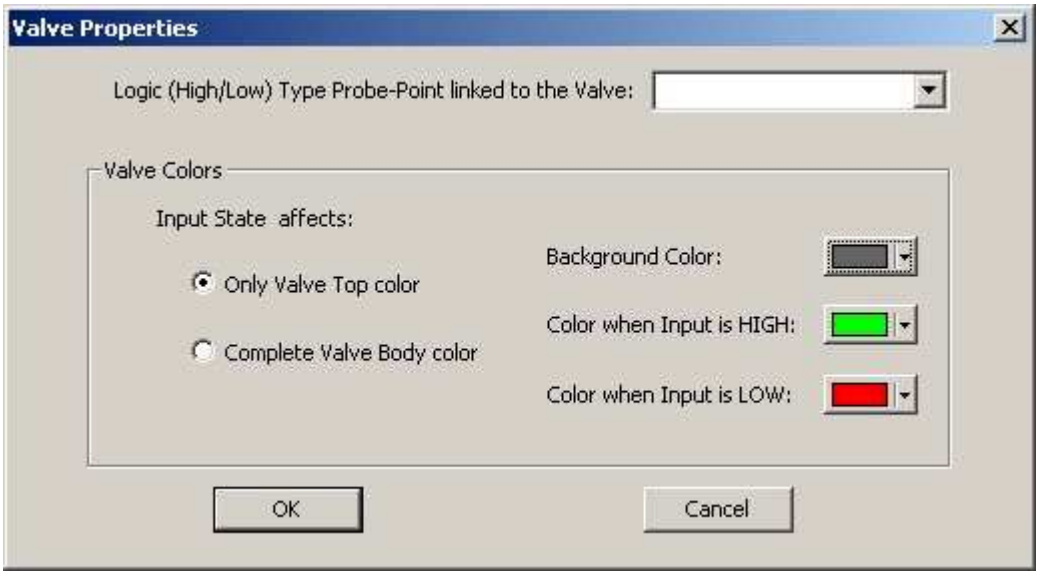
Font settings may be changed using the common Font Dialog.

Background Color

The color of each condition (above or below threshold) may be modified using a common Color Dialog. The Toggling Text control does not have a transparent background option.

VALVE

Value controls can be used to indicate High and Low conditions. A valve should only be associated with Logic Probe Points.



PROBE POINT LINK

This is described in the Probe Point Link section.

INPUT STATE AFFECTS

These options select whether the whole valve will be colored, or only the Top portion when the state of the associated Probe Point changes.

BACKGROUND COLOR

The Valve control does not have a transparent option.

COLOR WHEN INPUT IS LOW / HIGH

The color for each state can be modified using a common Color Dialog.

VIEWING WEB PAGES

There are two ways to monitor “live” data from the Logger. Both HyperWare-II’s RTT (Real-Time Trending) Window and the stand-alone GreenWater™ application can graphically display the latest Probe Point readings using Custom Web Pages.

GREENWATER

Similar to most browsers, GreenWater can access a Logger through its Ethernet connection (if it is using one). Unlike other browsers, it can also display special Custom Web Pages stored within the Logger and activate them to display live Logger data.

GreenWater can connect to a Logger over the Internet and display its data. Most object properties, such as color or scale notation, may be adjusted from within GreenWater, however objects cannot be moved or resized. Also the Probe Point associated with an object cannot be changed from GreenWater.

REAL-TIME TRENDING

From the RTT Window, Custom Web Pages can be designed, saved to files on the PC, or opened from files on the PC. The RTT Window can be used to display live Logger data using the Logger Probe Point List icon and the VCR-type control buttons shown below.

When stopped, RTT has all of the functionality of the Web Page Design Window. When running, it has all the power of GreenWater. For more information, refer to Chapter 8 (Real-Time Trending).

WEB PAGE DESIGN

In the Web Design Window it is possible to change which Probe Point is associated with an object. More than one object may display data from the same Probe Point. This is also the best place to move objects around in relation to the background, or to change the size of an object.

Web Page Design is done before the Program Net is uploaded to the Logger. This is because Custom Web Pages are part of the Program Net.

Since the Program Net is not running in the Logger, this Web Page Design Window does not have any live data to display.

17 APPENDIX D: ILIM-7 MODULE ICON REFERENCE

ISOLATED COLD JUNCTION COMPENSATION (CJC) ICON

FUNCTION:

The Cold Junction Compensation (CJC) temperature reading is taken from the integral temperature sensor of the CPU. This sensing function is critical in the calculation of thermocouple temperatures.

Cold junction compensation temperature is sensed using a device with a measurement range from –40 to +125C.

CONNECTION TERMINALS:

> **Note**: Internal input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

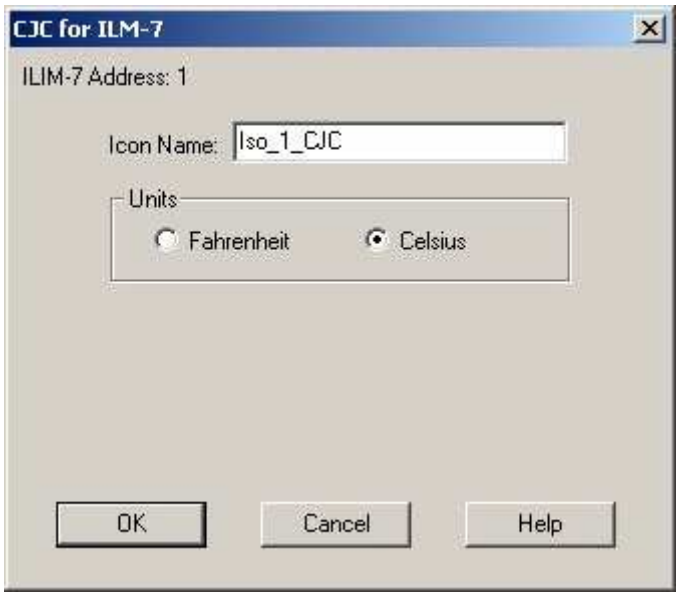
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided by the User, the default name will be "**Iso_#**" (# is the address of the module) followed by "**CJC**".

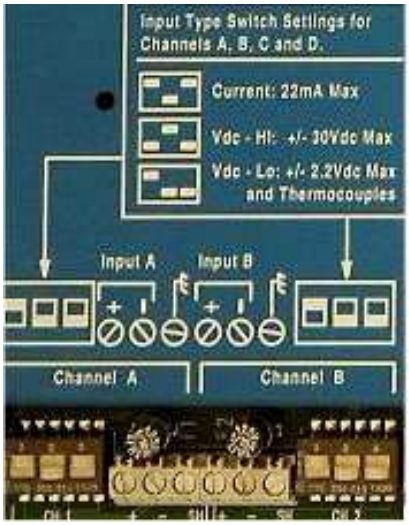
Units:

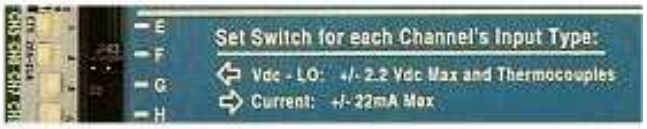
Specifies the temperature scale units that will be output from this icon. Celsius and Fahrenheit are directly supported, however, conversion to other units may be performed within a Program Net by adding a Math Icon onto this icon's output.

ISOLATED CURRENT (MA) ICON

FUNCTION:

The Inputs of the ILIM-7 Module can configured via DIP switches as Current, Voltage or Thermocouple Inputs. Channels A-D are configured as shown on the left, Channels E-H as shown on the right.


Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - Hi: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Input A
Input B
Channel A
Channel B



All 8 of these channels can be configured for Current. The mA Input icon performs the analog channel selection, amplification, and A-D conversion for a DC current input within the range of +/-22 mA.

CONNECTION TERMINALS:

> **Note**: Internal input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

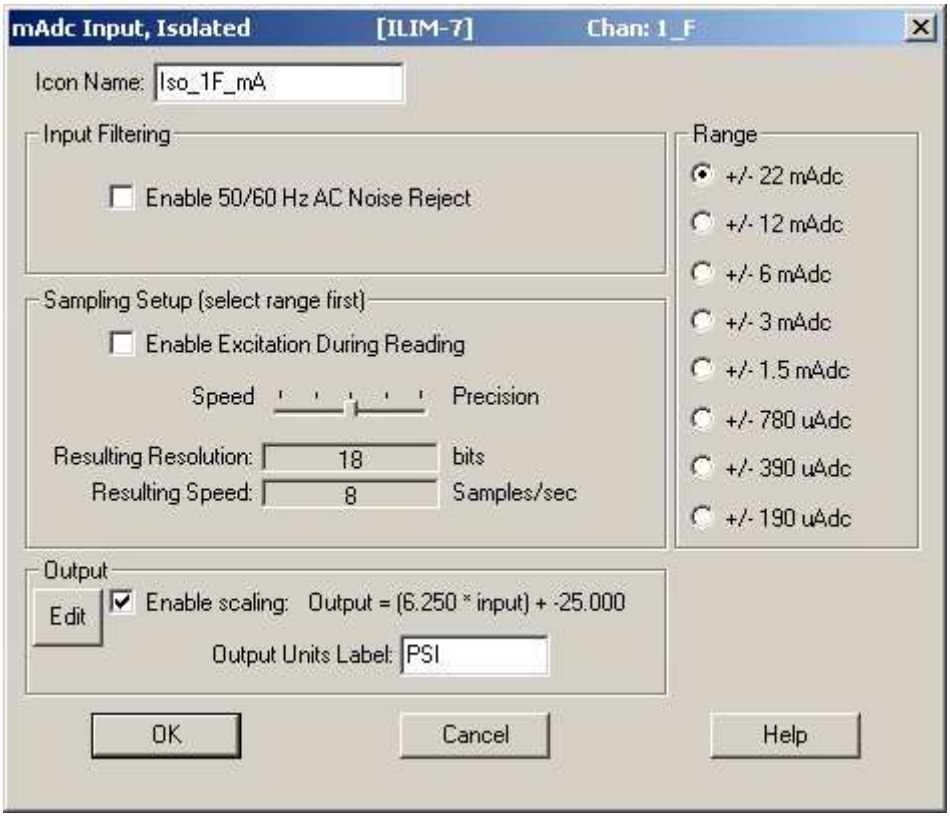
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided by the User, the Channel (A to H) on the Interface Module where the sensor is installed will be appended to the default name "**Iso_#**" (# is the address of the module) followed by "**mA**".

Enable 50/60 Hz AC Noise Reject:

When this is checked it enables software filtering of 50Hz or 60Hz noise on inputs.

Note: Enabling this prevents the option of adjusting Speed vs. Precision

Speed … Precision:

This setting determines the speed of an analogue to digital conversion traded off against accuracy of the reading. The following chart shows the accuracy (in bits of resolution) vs. speed (in samples/sec) for each of the 5 choices:

Choice	1	2	3	4	5
Samples per second	25	14	8	4	2
Bits of Resolution per Range					
22 mA	16	18	18	19	20
12 mA	16	17	18	19	19
6 mA	16	17	17	18	19
3 mA	15	16	17	18	18
1.5 mA	15	16	16	17	17
780 uA	14	15	15	16	16
390 uA	13	14	14	15	15
190 uA	12	13	14	14	14

Enable Excitation During Reading:

Only sensors that require external power to operate might use Excitation. This is Channel-specific and only activates the Excitation Voltage during the Reading of a Channel that has this box checked on the icon configuration dialog.

> **Note:** Excitation is current-limited to 25mA, and drives a 4.5 to 5 V output. Check for 4 wires on the sensor instead of 2. The extra wires would connect to the Excitation Terminals on the end of the board.

Range:

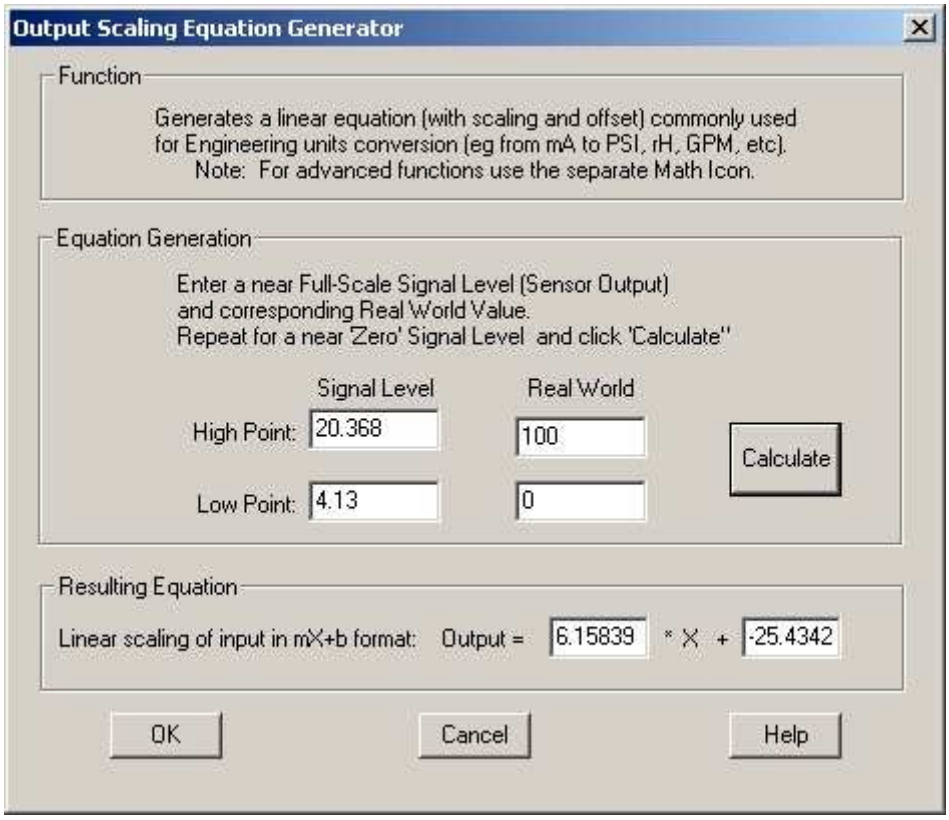
This specifies the range to be used for the channel. Select a range so that anticipated input signal fluctuations will not exceed this Full Scale range. If the input exceeds the selected range, an over-range value will be logged.

Enable scaling:

When this is checked, it enables the ***Edit*** button for automatic linear Equation Generation.

Edit:

In the example below, a 4-20 mA output pressure transducer is attached to the logger. The pressure transducer input range is 0-100 PSI.


Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate''
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

Output = mX + b

To create a function, enter the calibrated range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that this represents (here 0 to 100 PSI). Then select ***Calculate*** to generate the values for m and b (6.15839 and –25.4342, respectively). Finally, selecting ***OK*** returns to the main configuration dialog and puts the equation into the Function automatically.

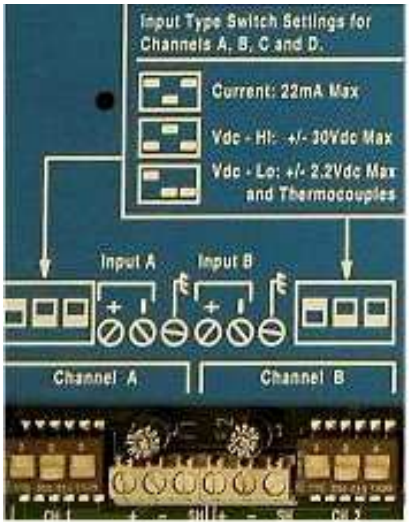
Output Units Label:

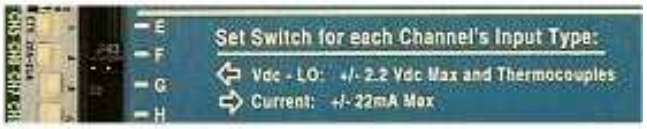
This specifies the Units that will be output from this icon. This will be kept at mA unless scaling is used to perform a conversion.

ISOLATED LOW VOLTAGE (VLO) ICON

FUNCTION:

The Inputs of the ILIM-7 Module can configured via DIP switches as Current, Voltage or Thermocouple Inputs. Channels A-D are configured as shown on the left, Channels E-H as shown on the right.


Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - Hi: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Input A
Input B
Channel A
Channel B



All 8 of these Channels can be configured for Low Voltage. The Low Voltage icon performs the analog channel selection, amplification, and A-D conversion for a DC voltage input within the range of +/-2.2 V.

CONNECTION TERMINALS:

> **Note**: Internal input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

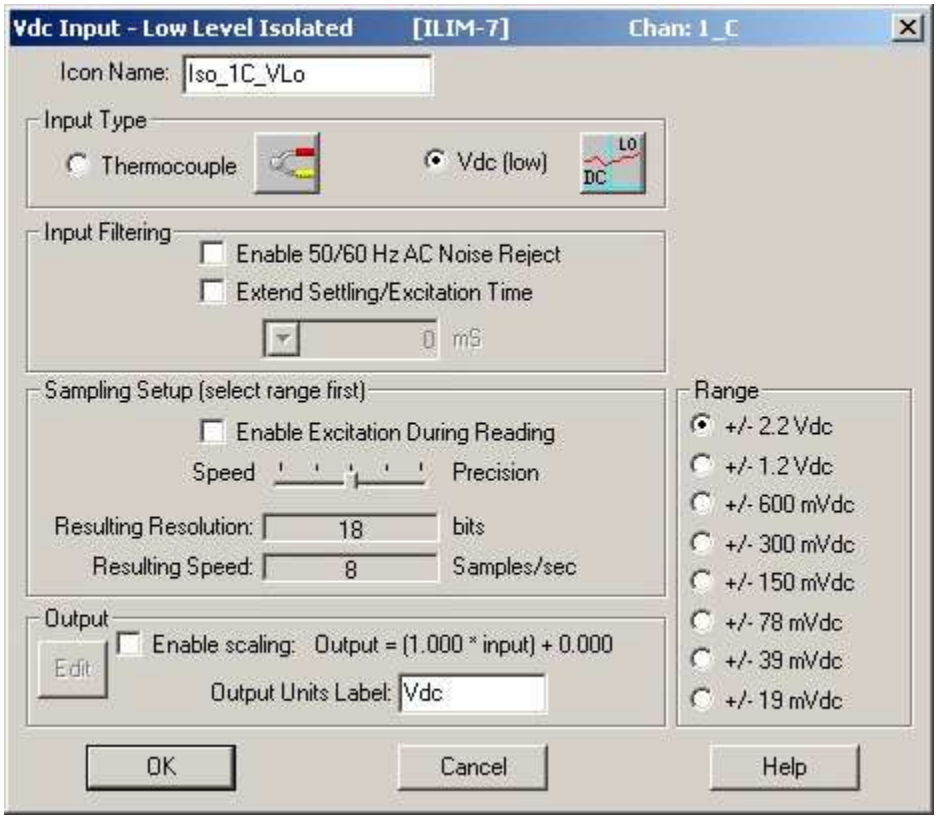
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided by the User, the Channel (A to H) on the Interface Module where the sensor is installed will be appended to the default name "**Iso_#**" (# is the address of the module) followed by "**VIo**"

Input Type:

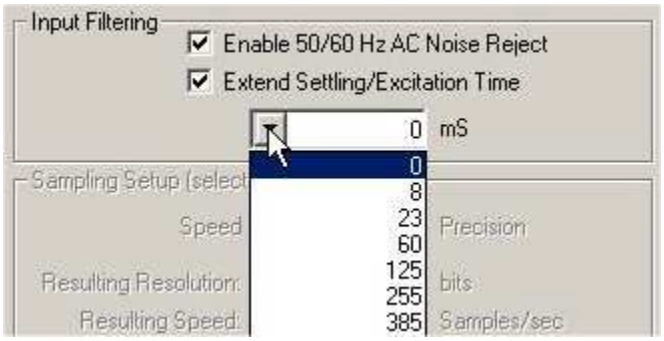
Both the Thermocouple (TC) icon and the Low Voltage (Vdc-Low) icon utilize the same Interface Module hardware Configuration Switch setting. Because of this capability, a Thermocouple Icon can be changed into a Vdc-Low icon by simply clicking on the button in the Configuration Dialog.

Enable 50/60 Hz AC Noise Reject:

When this is checked it enables software filtering of 50Hz or 60Hz noise on inputs.

Note: Enabling this prevents the option of adjusting Speed vs. Precision.

Extend Settling/Excitation Time:



This provides additional time for sensors that need to settle before readings can be taken. This setting might be changed if a user has a very high output impedance sensor or input divider to which the channel is being connected, or when using Excitation. The fastest setting is the default: zero additional milliseconds. A drop-down list allows the selection of increased settling times, up to almost 2 seconds, with the cost that it slows down the rate at which a channel can be sampled.

Speed … Precision:

This setting determines the speed of an ADC conversion traded off against accuracy of the reading. The following chart shows the accuracy (in bits of Resolution) vs. speed (in samples/second) for each of the 5 choices:

Choice	1	2	3	4	5
Samples per second	25	14	8	4	2
Bits of Resolution per Range					
2.2 V	16	18	18	19	20
1.2 V	16	17	18	19	19
600 mV	16	17	17	18	19
300 mV	15	16	17	18	18
150 mV	15	16	16	17	17
78 mV	14	15	15	16	16
39 mV	13	14	14	15	15
19 mV	12	13	14	14	14

Enable Excitation During Reading:

Only sensors that require external power to operate might use Excitation. It is Channel-specific; it only activates the Excitation Voltage during the Reading of a Channel that has this box checked on the icon Configuration Dialog. When using Excitation, select how much extra settling time it should use in *Extend Settling/Excitation Time* (above).

> **Note:** Excitation is current-limited to 25mA, and drives a 4.5 to 5 V output. Check for 4 wires on the sensor instead of 2. The extra wires would connect to the Excitation Terminals on the end of the board.

Range:

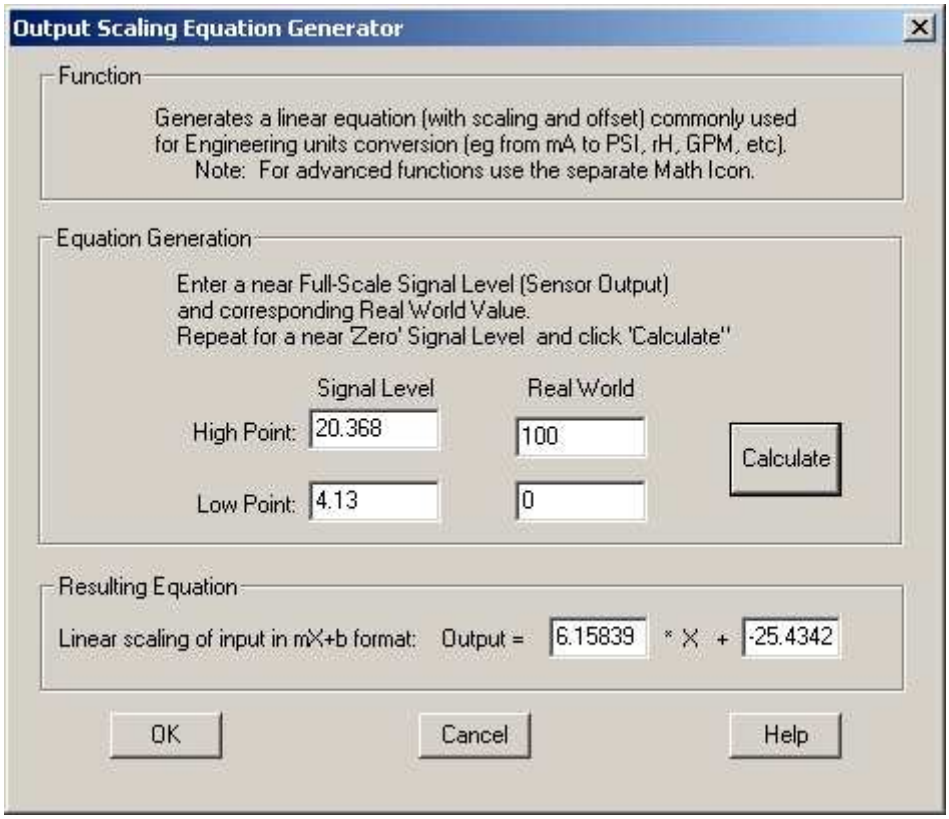
This specifies the voltage range to be used for this channel. Select a range so that anticipated input signal fluctuations will not exceed this full-scale range. If the input exceeds the selected range, an over-range value will be logged.

Enable scaling:

When this is checked, it enables the ***Edit*** button for automatic linear Equation Generation.

Edit:

In the example below, a 4-20 mA Output pressure transducer is attached to the logger. The pressure transducer Input range is 0-100 PSI.


Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate''
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

Output = mX + b

To create a function, enter the calibrated range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that this represents (here 0 to 100 PSI). Then select ***Calculate*** to generate the values for m and b (6.15839 and –25.4342, respectively). Finally,

selecting ***OK*** returns to the main configuration dialog and puts the equation into the Function automatically.

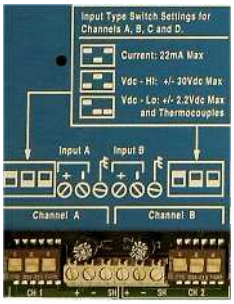
Output Units Label:

This specifies the Units that will be output from this icon. This will be kept at Vdc unless scaling (above) was used to perform a conversion.

ISOLATED HIGH VOLTAGE (VHI) ICON

FUNCTION:

The Inputs of the ILIM-7 Module can configured via DIP switches as Current, Voltage or Thermocouple Inputs. However only Channels A-D can be configured for HIGH Voltage.


Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - Hi: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Input A
Input B
Channel A
Channel B

CONNECTION TERMINALS:

> **Note**: Internal input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

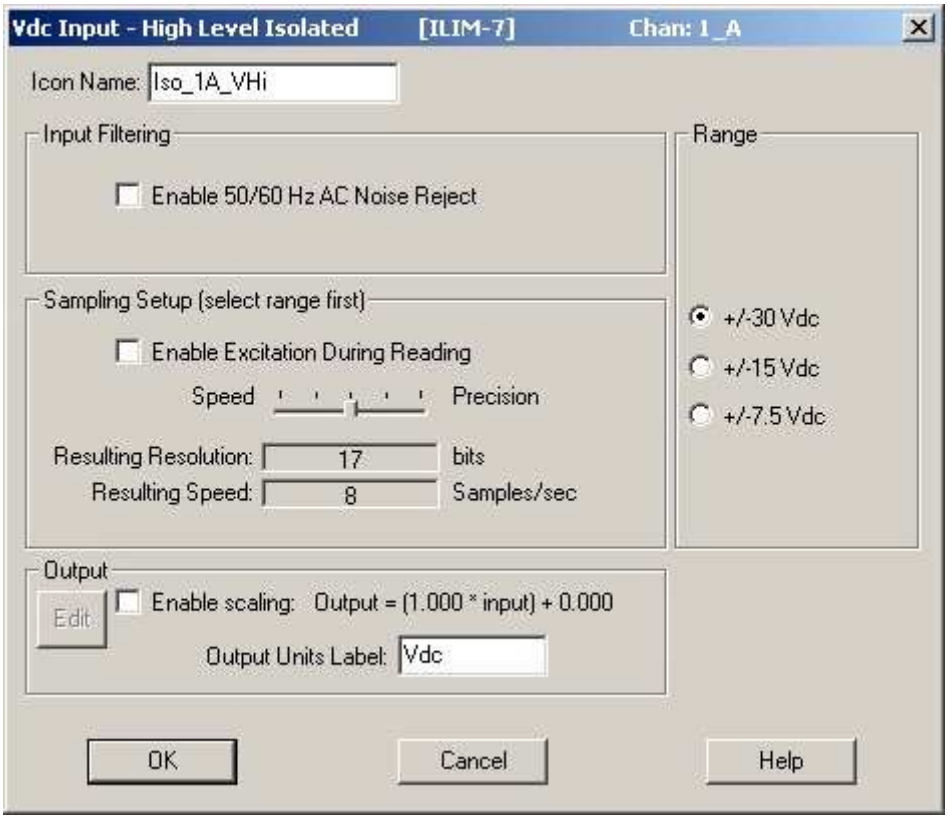
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to H) on the Interface Module where the sensor is installed will be appended to the default name "**Iso_#**" (# is the address of the module) followed by "**Vhi**"

Enable 50/60 Hz AC Noise Reject:

When this is checked it enables software filtering of 50Hz or 60Hz noise on inputs.

Note: Enabling this prevents the option of adjusting Speed vs. Precision.

Speed … Precision:

This setting determines the speed of an ADC conversion traded off against accuracy of the reading. The following chart shows the accuracy (in bits of Resolution) vs. speed (in samples/second) for each of the 5 choices:

Choice	1	2	3	4	5
Samples per second	25	14	8	4	2
Bits of Resolution per Range					
30 V	15	16	17	18	18
15 V	15	16	16	17	17
7.5 V	14	15	15	16	16

Enable Excitation During Reading:

Only sensors that require external power to operate might use Excitation. It is Channel-specific; it only activates the Excitation Voltage during the Reading of a Channel that has this box checked on the icon Configuration Dialog.

> **Note:** Excitation is current-limited to 25mA, and drives a 4.5 to 5 V output. Check for 4 wires on the sensor instead of 2. The extra wires would connect to the Excitation Terminals on the end of the board.

Range:

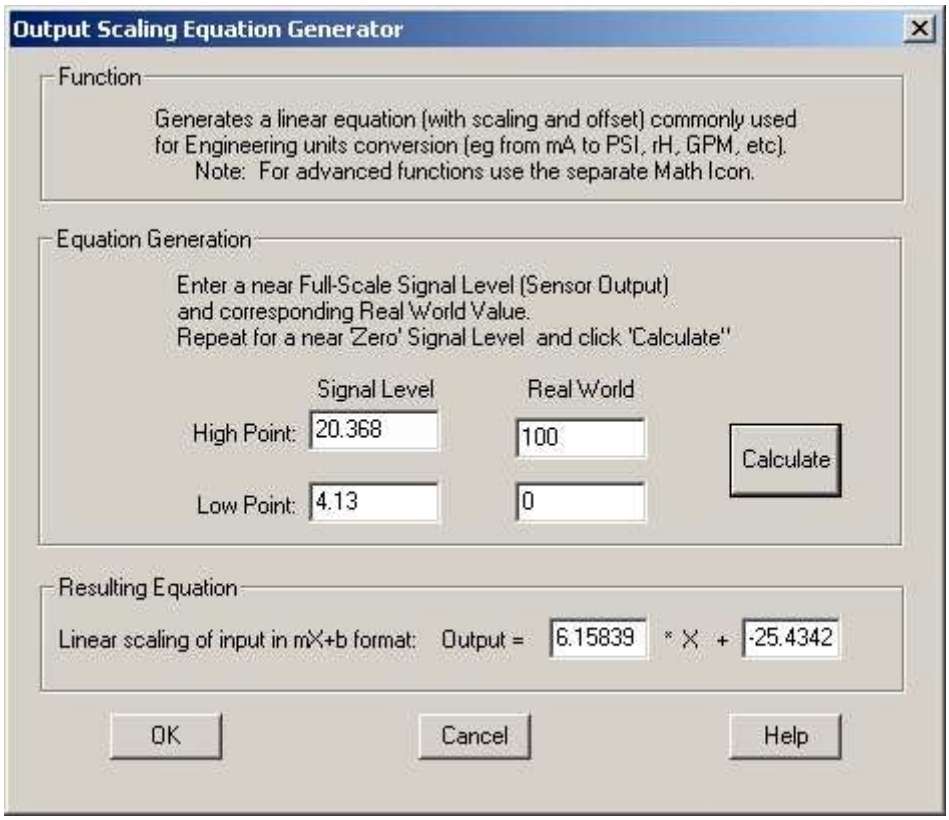
Specifies the range to be used for this channel. Select the range so that anticipated input signal fluctuations will not exceed this full-scale range. If the input exceeds the selected range, an over-range value will be logged.

Enable scaling:

When this is checked, it enables the ***Edit*** button for automatic linear Equation Generation.

Edit:

In the example below, a 4-20 mA Output pressure transducer is attached to the logger. The pressure transducer Input range is 0-100 PSI.


Output Scaling Equation Generator
Function
Generates a linear equation (with scaling and offset) commonly used for Engineering units conversion (eg from mA to PSI, rH, GPM, etc).
Note: For advanced functions use the separate Math Icon.
Equation Generation
Enter a near Full-Scale Signal Level (Sensor Output) and corresponding Real World Value.
Repeat for a near 'Zero' Signal Level and click 'Calculate"
Signal Level
Real World
High Point: 20.368
100
Low Point: 4.13
0
Calculate
Resulting Equation
Linear scaling of input in mX+b format: Output = 6.15839 * X + -25.4342
OK
Cancel
Help

An Equation Generator is provided for automatically creating linear equations of the form:

Output = mX + b

To create a function, enter the calibrated range of the Signal Level of the sensor that will be used. In this example that is 4.13 to 20.368 mA. Next, enter the range of values that this represents (here 0 to 100 PSI). Then select ***Calculate*** to generate the values for m and b (6.15839 and –25.4342, respectively). Finally, selecting ***OK*** returns to the main configuration dialog and puts the equation into the Function automatically.

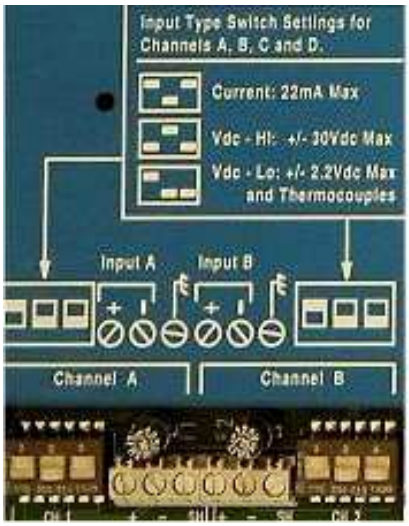
Output Units Label:

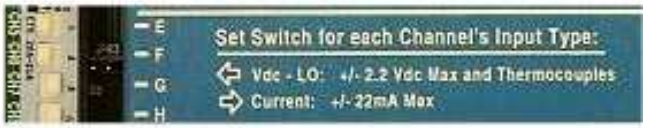
This specifies the Units that will be output from this icon. This is kept at Vdc unless scaling is used to perform a conversion.

ISOLATED THERMOCOUPLE (TC) ICON

FUNCTION:

The Inputs of the ILIM-7 Module can configured via DIP switches as Current, Voltage or Thermocouple Inputs. Channels A-D are configured as shown on the left, Channels E-H as shown on the right.


Input Type Switch Settings for Channels A, B, C and D.
Current: 22mA Max
Vdc - Hi: +/- 30Vdc Max
Vdc - Lo: +/- 2.2Vdc Max and Thermocouples
Input A
Input B
Channel A
Channel B



All 8 Channels may be configured for Thermocouples. The Thermocouple icon performs the thermocouple channel selection, amplification, CJC and A-D conversion for thermocouple hardware input. The CJC reading is taken from the thermal sensor on the CPU, described above.

CONNECTION TERMINALS:

Note: Internal input only. No Input Terminals are shown for icon connections in the Program Net.

Enable: Logic Control

Processing of icon is allowed:

when Enable terminal is unconnected

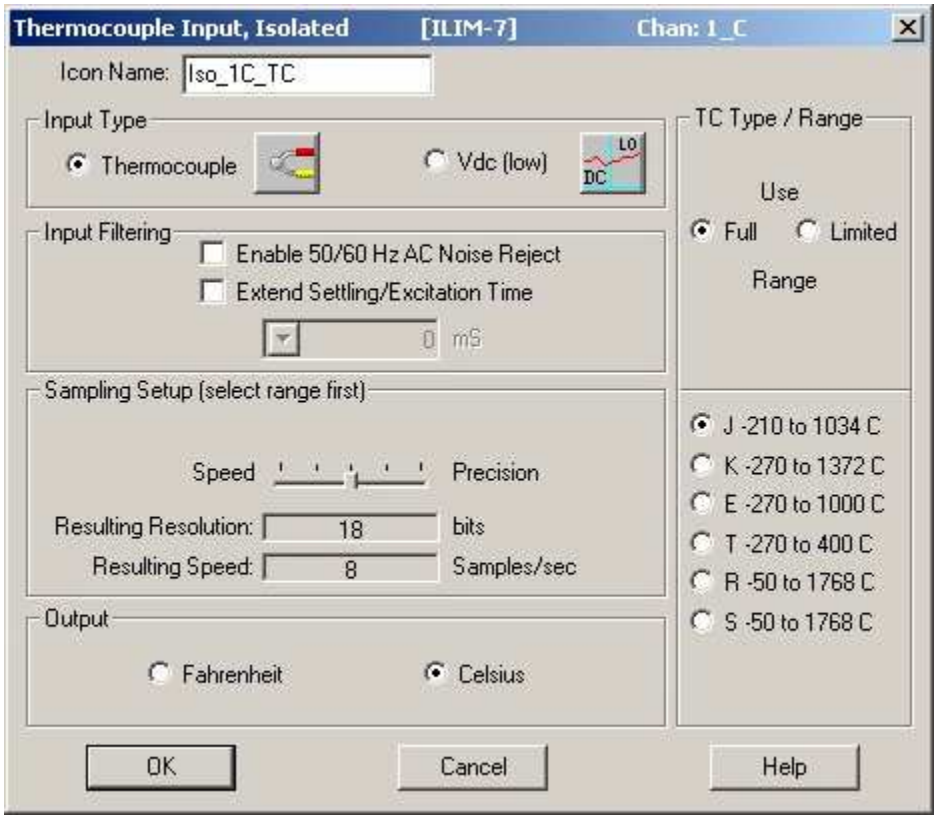
OR when connected *and* Enable signal is HIGH.

Trigger: Logic Control

Output is generated upon each Trigger Pulse, if the icon is enabled.

Output: Analog Data.

CONFIGURATION DIALOG:



CONFIGURATION OPTIONS:

Icon Name:

This is a user-defined label that is shown below the icon within the Net Programming Window. If no name is provided, the Channel (A to H) on the Interface Module where the sensor is installed will be appended to the default name "**Iso_#"** (**#** is the address of the module) followed by "**TC**"

Input Type:

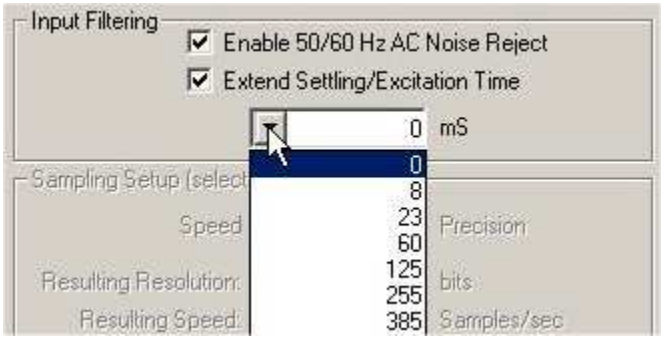
Both the Thermocouple (TC) icon and the Low Voltage (Vdc-Low) icon utilize the same Interface Module hardware Configuration Switch setting. Because of this capability, a Thermocouple Icon can be changed into a Vdc-Low icon by simply clicking on the button in the Configuration Dialog.

Enable 50/60 Hz AC Noise Reject:

When this is checked it enables software filtering of 50Hz or 60Hz noise on inputs.

Note: Enabling this prevents the option of adjusting Speed vs. Precision.

Extend Settling/Excitation Time:



Provides extra time for sensors that need to settle. This setting might be changed if a user has a very high output impedance sensor or input divider to which the channel is being connected. The fastest setting is the default of zero additional milliseconds. A drop-down list allows the selection of increased settling times, up to almost 2 seconds, with the cost that it slows down the rate at which a channel can be sampled.

Speed … Precision:

This setting determines the speed of an analogue to digital conversion, which is traded off against accuracy of the reading. The default is the middle setting. The speed remains constant for each of the 5 choices, however the precision is also contingent upon the range setting (below).

The following chart shows the accuracy (in bits of Resolution) vs. speed (in samples/second) for each of the 5 choices for the Ranges:

Choice	1	2	3	4	5
Samples per second	25	14	8	4	2
Bits of Resolution per Range					
J	16	18	18	19	20
K	16	17	18	19	19
E	16	17	17	18	19
T	15	16	17	18	18
R	15	16	16	17	17
S	14	15	15	16	16

Thermocouple Type / Range:

This specifies the type and range of Thermocouple that is attached to this icon's input channel on the Edge Connector. The temperature range is displayed next to the ANSI code for the sensor, according to the units selected in output (see below). Selecting Limited provides greater precision over a smaller range, much like zooming in. The Range selection will also affect the *Speed…Precision* setting (described above) if it is being used.

Note: There is no Limited Range (zoomed-in) option for S type Thermocouples.

Output:

This specifies the Units that will be output from this icon. Celsius and Fahrenheit are directly supported. The range for different types will change automatically as the output units change. Conversion to other units can be performed within a Program Net by adding a Math Icon onto this icon's output.

18 NOTES

19 REVISION HISTORY

APRIL 30, 2009

- Updated Modbus Slave Icon Configuration Dialog screen captures.
- Moved Modbus Register List Icon to System Base Icon chapter.

MARCH 12, 2009

- Updated Modbus images: new dialogs, SCC-1 and SCC-1 PCA.
- Added information on the Inter-Message Delay Multiplier.
- Added definitions for Modbus System Status bits and RTU Slave mode error codes.
- Added accessible variable types for registers when in Modbus RTU Slave mode.
- Updated real-time trending images and a cross-reference.

FEBRUARY 12, 2009

- Fixed chapter and figure numbering errors.
- Added RS-485 cable recommendation.
- Added Scheduler icon information.
- Added note about “Enable Optional Use” checkbox for SCC-1 operation.

JANUARY 29, 2009

- Added Modbus chapter and updated various pre-existing Modbus references to go along with the new Modbus release.
- Updated screen captures and text for ILIM Properties dialog.
- Updated screen captures for Logger Configuration dialog and added Modbus tab description.

20 INDEX

5

5Vdc Output Icon 330

A

Accessory Components
- Cellular Modem 23
- CF Card 23
- PSTN Modem 23
- RF Links 23

Active Messages 30, 188, 202, 247, 341
Alarm 30
Analog Outputs
- Output Characteristics 38

AND Icon 251
Angular Gauge Objects 382
Average Icon 303

B

Bar Meter Objects 386
Basic LCD Display Hierarchy 30
Battery 187, 227
Battery Icon 363
Baud 78, 80
BBus
- Communication Error 325
- Interconnect 40
- Module Address 41
- Power Booster 43

C

CF Card
- Clearing 103
- Downloading Data 176
- Expanded Data Storage 174
- Formatting 30
- Formatting 341
- Reader 96
- Socket 39

Channel Name 411
CJC 205, 227, 250, 436
CJC Icon 334, 421
CJC Recalibration 343
Cold Junction Compensation 49, 334, 343, 421
Common Mode Input Range 34
Compact Flash *See* CF Card
Comparator Icon 198, 208, 326
Configuration Switches 32, 33, 46
Connections 31, 37, 38, 46, 53, 94
- +5V Output 36
- Analog Outputs 38
- BBus 39
- CF Card 39
- Communications 38
- Digital Outputs 37
- Ethernet 39
- GPDI Input Signal 35
- Power and Ground 31
- Relay Outputs 37
- RS232 (COMM) 38
- RS232 (PC) 38
- USB 38

Constant Icon 206
Counter Icon 208, 318
Custom Web Page Icon Reference 372
Custom Webpage Icon 211

D

DAC Icon 332
Data Download 59, 65, 102, 105, 174
- File Formats 174
- Procedure 175

Data Processing 181
- Convert XID File 182
- Plot File Data 183
- Verify File Integrity 181

DC-HI Icon 432
DC-LO Icon 367, 427
Delay Icon 217
Delta Icon 219
Diagnostic Log 109
Digital Output Icon 336
Digital Readout Objects 389
Display *See* also LCD
Display Probe Icon Values 101
Duty Cycle Icon 221

E

Email Icon 223
ENABLE button 28
Enter Data Marker 30
Erase Logged Data 30
Event icon 35

F

Filter Icon 242
Filtering
- 50/60 Hz Rejection 354, 365, 424, 428, 433

Flip Flop Icon 290
FTP Icon 233
Fuses
- Access Cover 32
- ILIM-7 Input Protection 51
- ILIM-7 Module Protection 48
- Power Fuse 32
- Removal 48

System Base Protection 34

G

General Purpose Digital Inputs 35
Global Icon 140, 338
GPDI
Counter Input Application 36
event type input application 35
Frequency Input Application 36
GPDI Counter Icon 346
GPDI Event Icon 344
GPDI Frequency Icon 349
GreenWater
Accessing Remote Values 160
Control Values 190
Custom Pages 195
Home/Status 187
Logged Data 191
Menu/Toolbar 186
Overview 186
Remote Constants 160
Remote Switches 160
Viewing Probe Points 159

H

Home Menu 30
Hyperlink Objects 391
HyperWare-II
Features 59
Installation 59
Overview 59

I

Icon
Configuration 197
Terminals 197
Topography 135
Icons
5Vdc Output 330
Analog Output 332
Battery 363
CJC 334, 421
Comparator 198
Constant 206
Counter 208
DC-HI 432
DC-LO 367, 427
Delay 217
Delta 219
Digital Output 336
Duty Cycle 221
Email 223
Filter 242
Flip Flop 290
FTP 233
Global System Settings 338
GPDI Counter 346
GPDI Event 344
GPDI Frequency 349
Latch 245
LCD Event 247
LCD Status 202
LED Output 351
Logical AND 251
Logical NOT 255
Logical OR 257
Logical XOR 253
ma LO 353
mA LO 423
Math 260
Memory 214
Min/Max 266
Modbus 372
Modbus Register List 356
Modbus Slave Device Register 269
Mux 274
POI 276
Probe Point 279
Relay Alarm 361
Remote Constant 284
Remote Control (Switch) 288
ROC 282
Sample Rate Clock 292
Scheduler 296
Start/Stop Clock 300
Statistical Average 303
Stop 306
Stopwatch 308
Summation 310
Text Note 313
Thermocouple 364, 436
Time Integral 315
Timed Counter 318
Warm-up 321
Warning 323
Webpage 211
Window Comparator 326
ILIM-7
Channel Configuration 48
CJC 49
Configuration Switches 47
Excitation Output 51
External 44
Input Types 46
Integrated 45
Isolated Analog Input Module 44
Mounting 55
Over Current Protection 48
ILIM-7 Module Icon Reference 421
Image Objects 393
IntelliLogger
Analog Inputs 32
Analog Outputs 38
Digital Outputs 37
Enclosure and Mounting 26
Features 23
GPDI Inputs 35
Indicators 31
Model Variations 25

Relay Outputs 37
System Base 20, 25
System Base Input Ranges 34
System Base Over Current Fuses 34
System Components 20
The Big Picture 20
User Interface 28
Interface Modules 21
Name 43
Reflash Firmware 42
Invertor Icon 255

L

Latch Icon 245
LCD 29, 340
Operation 29
LCD Event Icon 247
LCD Status Icon 202
LED Bar Graph Objects 396
LED Objects 394
LED Output Icon 351
Linear Gauge Objects 399
Logarithmic Gauge Objects 402
Logger Time 100

M

mA LO Icon 353, 423
Math Icon 260
Memory Status 189
Min/Max Icon 266
Modbus
Allowed Addresses 126
Bitrate 123
Filter Client Addresses 126
Interfacing to slow response Slave devices 123
Inter-Message Delay Multiplier 123
Logger Configuration Tab 121
Logger Modbus Address 124
Logger TCP Port 126
Master/Client or Slave/Server 123
Parity 123
Priority Addresses 126
Response Timeout 123
RTU and TCP 122
RTU Master 121, 122, 146
RTU Slave 121, 124, 146, 149
SCC-1 *See* SCC-1
Stop Bits 123
Swap Data Register Order 125
TCP Server 121, 125, 146, 151
Use Subnet Masks 126
Modbus Icon 372
Modbus Register List Icon 356
Modbus Slave Device Register Icon 269
Module Stacking 56
Motor Objects 405
Multiplexer Icon *See* Mux Icon
Mux Icon 274

N

NEXT button 28
NOT Icon *See* Invertor Icon

O

Odometer Objects 407
OR Icon 257

P

Palette Icon Reference 197
Performance
Considerations 143
Guidelines 142
Periodic Ouput Icon *See* POI Icon
Pipe Objects 409
Plotter Objects 410
POI Icon 276
Power Switch 29
Probe Point 30
Probe Point Icon 279
Program Net
Documentation 144
Example 130
Loading and Saving Files 131
Polling for Hardware 132
Programming 62
Programming Overview 129
Programming Window 131
Saving 142
Upload to Logger 144
Wiring Printout 144

R

RAM (Memory) Icon 214
Relay Alarm Icon 361
Relay Outputs
LED Indicators 37
Switching Capacity 37
RESET button 28
ROC Icon 282

S

Sample Rate Clock Icon 292
SCC-1 152
Configuration 154
IntelliLogger Configuration 153
Wiring 153
Scheduler Icon 296
SELECT button 28
Serial Comm Converter *See* SCC-1
Set Logger Time 103
SRC *See* Sample Rate Clock
Start/Stop Clock Icon 300

Status 30
Status Indicator LEDs 29
STOP button 28
Stop Icon 306
Stopwatch Icon 308
Summation Icon 310
Surface Mounting 55
Switch Icon 288
System Base Icon Reference 330

T

Tank Level Objects 412
Text Label Objects 413
Text Note Icon 313
Thermocouple Icon 364, 436
Thermocouples
  Types and Ranges 33
Thermometer Objects 415
Time Integral Icon 315
Toggling Text Objects 418

V

Valve Objects 419
Variable Icon 284

W

Warm-Up Icon 321
Warning Icon 323
Watch-Dog Timer reset 29
Web Design
  Configuring Objects 168
  Palette 167
  Viewing Web Pages 173
  Web Page Objects 168
Web Page Objects
  Common Properties 374
Windows
  Custom Web Page Design 163
  Real Time Trending 155
  Resizing 165
  Setting the Background 166

X

XOR Icon 253